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GENERAL VIEW

OF THE

GEOLOGY OF SCRIPTURE.

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GENERAL VIEW

OF THE

GEOLOGY OF SCRIPTURE,

IN WHICH THE UNERRING TRUTH

OF THE

INSPIRED NARRATIVE

OF THE EARLY EVENTS IN THE WORLD IS EXHIBITED, AND DISTINCTLY
PROVED, BY THE CORROBORATIVE TESTIMONY OF
PHYSICAL FACTS, ON EVERY PART OF
THE EARTH'S SURFACE.

By GEORGE FAIRHOLME, Esq.

> "The great danger of Philosophy is its application—not to things that *are*, or *may be*, but to the speculations for the constructure of things *that are not*. Men of science too often imagine vanities, and support them by plausible arguments, until, lost in the wonderment of their supposed discoveries, and unable to apply them to simple *truth*, their future undertakings and writings avouch the scepticism of their bewildered minds."

PHILADELPHIA:
KEY & BIDDLE, 23 MINOR STREET.
T. K. COLLINS & CO. PRINTERS.
1833.

Gift
Tappan Presb. Ass
2-13-1932

02-15-32 HWS

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PREFACE.

In presenting the following pages to the judgment of the world, I have reason to fear, that the very *title* of the work will excite, in the minds of some, feelings by no means favourable to an unprejudiced perusal of it.

I am fully aware of the objections which have frequently been raised to the endeavours to connect physical facts with the details of scripture; and I am, also, aware of the mischief that has sometimes ensued to the cause of religion, from the imprudent or unskilful defence made by those whose wishes and intentions were the most friendly to it.

The course of every science must be progressive; beginning in faint attempts to dissipate the obscurity of ignorance, and gradually advancing towards the full light of truth. To this usual course, the science of geology cannot be considered as an exception, having already passed through some of its early stages, which were avowedly marked with obscurity and error. During these stages of geological ignorance, I am free to admit, that the attempt to connect the supposed discoveries in the physical phenomena of the earth, with the truths announced to us in the sacred record, could not but tend to injure either the one cause or the other; because, it is impossible that any concord can exist between *truth* and *error*. In this case it unfortunately happened that the assertions of philosophy were uttered with such boldness, and so supported by *the deceptious evidence of physical facts, seen under a false light*, that it was difficult for the supporters of revelation, ignorant, as they generally were, of the nature of these facts, to hold their ground with success, or not to weaken their own cause by an apparent failure in its support.

The necessity which has, however, been acknowledged, of rejecting the geological theories of those days, opposed, as they were, to the Mosaical History, was, therefore, a fair source of hope and encouragement to such as advocated the *unerring* character of Inspired Scripture. It, at least, left that Mosaic Narrative uninjured by the assault; and encouraged a hope, that, as in all other cases, the *truth* would finally *appear* and *prevail*.

It has been well remarked, by the able author of a work which has lately appeared, full of information, and written upon the soundest principles,—"It is now thirty-five years since my attention was first directed to these considerations. It was then the fashion for science, and for a large part of the educated and inquisitive world, to rush into a disbelief of all written Revelation; and several geological speculations were directed against it. But I have lived to see the most hostile of these destroyed by their own as hostile successors; and to observe, that nothing, which was of this character, however plausible at the moment of its appearance, has had any duration in human estimation, not even among the sceptical."*

Of late years, accordingly, fact after fact has been gradually accumulating; each tending to temper the wild character of an hypothetical philosophy; and every day produces some new evidence of the hasty and erroneous conclusions from physical facts, to which the friends of Revelation had found it too often necessary to succumb.

Each of these *errors* in philosophy has been a source of triumph to the cause of *truth;* and the time is gradually approaching, if it be not yet fully come, when the trial must be brought to a positive issue, and when those undeniable physical facts, *seen in a new and more correct light*, will lend their aid to the *support* instead of to the *destruction* of our confidence in Scripture; and when the *simplicity* and *consistency* of the Geology of Scripture, will make us regard with astonishment and contempt, schemes that could so long have exerted so powerful an influence over our reason and understanding.

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* Sacred History of the World, by Mr. Sharon Turner.

I am not vain enough to suppose that I am myself qualified to bring about so desirable an end: but, as it is the duty of every one to lend a hand to the demolition of ERROR, and to the encouragement of TRUTH, I propose, in the following pages, to endeavour, in as clear and concise a manner as the subject will admit of, to account for the geological structure of the upper surface of our earth; taking the Mosaical History for my guiding star, to be kept constantly in view throughout my course.

A great part of my object will be attained, if I can succeed in bringing any one of those able minds, who are now so influential in the geological world, to view, in the same light as myself, the phenomena presented to our examination on the earth. I am persuaded, that many of those individuals, so distinguished in science, are not so wedded to a party or theory, as not to acknowledge and retract an error in judgment, if they are convinced of its existence.

Amongst the many unquestionable physical facts, therefore, which I hope to be able to produce in the course of this treatise, supporting, in a remarkable manner, the Sacred History of the early events in the world, should any thing be found sufficiently strong, and sufficiently pointed, to shake the foundations of many of the present received opinions in geology, I hope that some one, or more, of those gifted individuals, may be found with sufficient candour to retrace his steps, and to lend the aid of a powerful and active mind to the cause of Revelation.

It is, however, to be feared, that there are many geologists, (if indeed they are deserving of the name,) whose great delight in this subject arises from the *play of fancy* its consideration, under a false view, gives rise to; and who would, consequently, be unwilling to yield so pleasing a source of argument and hypothesis to the plain and simple course of events which the Mosaical History unfolds.

Notwithstanding, however, the opposition I may meet with from such theorists, and in the absence of more able advocates for the support of this view of the subject, I propose to follow the course I have laid down; and I feel perfectly confident, that any failure in the proposed plan will not arise from the defective nature of the plan itself, or from the materials within my reach for the completion of it; but merely from the inability of the *builder*, which defect may, at any time, be remedied, by the same materials being placed in the hands of a more able, though not more zealous advocate for the cause of *truth*.

It must, however, be kept in view, that it is not the object of this treatise to enter minutely, or in detail, into the nature and history of each particular formation in the upper strata of the earth. We must first lay a solid foundation for our views, by an enlarged and general *system;* and when this great and primary object has been perfectly attained, we may then, with safety, examine in detail the many interesting objects presented to our inspection, without, at any time, however, losing sight of the great first principles by which we had found it expedient to be guided in our course. We may thus hope to be led, by the full light of day, through those devious paths, over which so complete a twilight has hitherto been spread; and we shall, undoubtedly, have the gratification of finding, that the same dignified simplicity and truth which have always been remarked as the characteristics of the other parts of Inspired Scripture, are not less remarkable, in the concise but emphatic details of the early events of the world.

GEOLOGY OF SCRIPTURE.

INTRODUCTORY CHAPTER.

The very high interest and importance of the history of the globe which we inhabit, will be admitted by all whose minds are capable of entering beyond a mere superficial consideration of the objects around us; and the principles of curiosity, and the innate love of truth, so inherent in the human mind, lead us, step by step, from the consideration of objects themselves, to the GREAT FIRST CAUSE from whence all things have originally sprung.

I have always felt an ardent desire to study, and endeavour to follow up, the theories which, from time to time, have been formed by philosophy, respecting the original formation and subsequent changes of the globe which sustains us; and for many years of my life I have regularly studied almost every thing that has been advanced on those important subjects. In the course of repeated travels over a great part of Europe, I have also had many opportunities of practically forming a judgment of the more visible and tangible evidences adduced in support of those theories. I have never felt, however, either on the subject of the *primitive* or *secondary* formations of geology, that firm conviction of the truth of the doctrines taught by the great leaders in science, which is the necessary consequence to be looked for in sound and truly logical reasoning. In the very opening of the subject, in treating of the *mode of first formations*, and in the *numerous revolutions* which are said subsequently to have left unquestionable traces upon the earth, I have never found any argument advanced which did not leave the mind in a bewildered and uncertain state; and in but too many of the theories of philosophy on these subjects, we find opinions broached by the very ablest men, so extraordinary, and so repulsive to our reason and common sense, that we are compelled at once to reject them, and not without losing, at the same time, some portion of that high respect, with which a sound philosophy ought always to inspire us.

In the course of these studies, I have never been able to exclude from my mind those lights and beacons held out, as it were, for our guidance, in tracing the more obscure portions of the history of the earth, by the inspired writings, of the truth of which, on *other* subjects, the unprejudiced mind can entertain not a shadow of doubt, strengthened as they are by the great and wonderful events which have been foretold in prophecy, and, subsequently, literally fulfilled in *history*.

"The great problem of creation has been said to be, 'MATTER *and* MOTION *given*, to *form a world;*' and the presumption of man has often led him to attempt the solution of this absurd problem. At first, philosophers contented themselves with reasoning on the traditional or historical accounts they had received; but it is irksome to be shackled by authority, or for the learned to be content with the same degree of information on so important a subject as the most ignorant of the people. After having acquired, therefore, a smattering of knowledge, philosophy began to imagine that it could point out a much better way of forming the world, than that which had been transmitted by the consenting voice of antiquity.—Epicurus was most distinguished among the ancients in this work of reformation, and produced a theory *on the principle of a fortuitous concourse of atoms*, the extravagant absurdity of which has alone preserved it from oblivion. From his day to the present time, there has been a constant succession of *systems and theories of the earth*, which are now swallowed up by those of a chaotic geology, founded on chemistry; the speculations of which have been attended with many useful results, in so far as they proceed on the principles of induction; but when applied to solve the problem of *creation*, or the *mode* of first formations, will only serve, like the systems of their forerunners of antiquity, to demonstrate the ignorance and presumption of man."*

* Edinburgh Encyclopedia.

Unfortunately for the cause of truth, and of sound philosophy, the study of geology was begun, at no very distant period, in a school where the only *history* which could be consulted on such a subject was neglected and despised, on points incomparably more important than scientific inquiries. We cannot, therefore, feel surprise, that the philosophy of that period should have excluded from its view the concise but most important geological information given us in the first part of the Mosaical history.

Misled by the theories of the earth set forth by the continental philosophy and infidelity, theories so wild and absurd, that sober reason now looks upon them with contempt; many zealous and able men of our own country have been hurried away by the torrent, and have been induced to follow out their own researches, under the delusive and prejudiced impressions of their early studies.

Even some of the most learned divines, without any knowledge of geology, have considered themselves bound, in translating and explaining the sacred record, to submit to the dictates of philosophy, and by taking liberties with the original text, which would not be tolerated in translating any classic author, have thus unintentionally aided the cause of scepticism and unbelief. They have admitted a doubt upon a great and fundamental point, in which the inspired history, fairly translated, directly opposes them; viz. in conceding to the theories of philosophy *the duration of the six days of the creation*. As it was contrary to these theories to admit the *perfect* CREATION of all things, at the first, by an Almighty Power, it became necessary to search for such *secondary causes*, as would, *by the mere laws of nature*, as they are called, have produced the primitive rocks, as we now find them.* These supposed *causes* were discovered in

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* In the understanding which has, in a manner, been tacitly agreed upon in science, carefully to exclude every allusion to the Deity, in the contemplation of his works, we constantly find the unmeaning name of *Nature* introduced, even in pages where the admiration of HER *works* would make it appear impossible to avoid an acknowledgment of *him* from whom all things have arisen. In a posthumous treatise by Milton, we find the following just reflections on this subject.—"Though there be not a few who deny the existence of God, for 'the fool hath said in his heart, there is no God,' (Psal. xiv.) yet the Deity has imprinted on the human mind so many unquestionable tokens of himself, and so many traces of him are found throughout the whole creation, that no one in his senses can long remain ig-

chemistry; and as it was found by chemists that various substances, under certain circumstances, formed themselves into crystals, and, by geologists, that granite, and other primitive rocks, had a crystalline appearance and formation, it was assumed as a *fact*, assisted by the heathen notion of a *chaos*, that all matter once existed in a confused and imperfect mass, from which, in the course of some indefinitely long period of time, our globe, in all its crystalline beauty, must have *formed itself*. We are no where informed by this chaotic philosophy whence the *material atoms*, of which this imperfect compound was formed, were produced; how the liquid mass was held together before the laws of attraction and of gravity were ordained; or by what power the laws of *nature*, by which crystallization takes place, were first instituted.

By some philosophers of the French school, this theory of *gradual* perfection was extended even to animated beings. They considered that life, in its lowest shape, was first generated in this fermenting mass, and that the present variety and perfection, so remarkable in the animal world, gradually arose from those species of marine creatures called zoophytes, resembling, as their name denotes, the order of plants. It is not easy to determine the original ground-work for so extraordinary and impious a theory; but it probably arose, in some

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norant of the truth. There are some who pretend that *nature*, or *fate*, is the supreme power; but the very *name of nature* implies that it must owe its *birth* to some prior agent; and *fate* can be nothing but a divine decree, emanating from some superior power."

We must, however, in justice admit, that, in the minds of many, the *exclusion* above alluded to has been acceded to with the very best intention, though this admission may be looked upon as a proof of that very tone in philosophy in general, which is so often opposed to the great truths of Revelation; for, in the obscurities under which many of the phenomena of creation are still viewed, and under the impression of such obscure and erroneous theories as have been put forth by philosophy, men of the soundest faith must have found themselves so constantly involved in contradiction to the records of inspiration, in the course of their scientific researches, that it would be found more advantageous to the cause of religion to accede to this entire exclusion, than to confound and shatter *both*, by such continual collision as must occur, till the views of creation become more enlightened, and complete concord is established between Revelation and the phenomena of the world around us. This desirable and *inevitable* concord is every day advancing with rapid strides; for, however the theories of philosophy may change, the Rock of Revelation stands for ever immovably fixed.

degree, from the erroneous conclusions from fossil remains, which have been the fertile cause of so much misconception during the last century. It has been remarked by geologists, that the only fossil remains of animated beings to be found in the earliest secondary rocks, are of this description of zoophytes; and it has therefore been concluded as a *positive fact*, that zoophytes were the first and most imperfect of animated beings, from which, by a living principle in nature, all other improvements have gradually sprung up. It may easily be imagined to what absurdities such theories must have led, and from them we may trace the systems of Lamarck, who held, amongst others, the following extraordinary opinions. He considered that all the forms of animated beings, as they now exist, must have been gradually developed, as their wants and necessities demanded. For instance, the deer, and the antelope tribe, had not originally the delicate forms and nimble activity they now display; these qualities were produced by the *necessity* of flying from their enemies, and of seeking safety by rapid flight. The aquatic birds and beasts having *webbed feet* to assist them in swimming, had no such helps in their primitive condition, but by constant action and exertion of the toes, the membrane connecting them at length became extended. But one of the most whimsical of these ideas, perhaps, relates to the unusual length of neck exhibited by the cameleopard, which is described as being originally much like other animals; but by the habit of feeding on branches of trees, it gradually assumed the form we now look upon with admiration. Such glaring absurdities as these have long ceased to find supporters; but it is no less certain that the idea of gradual creation, or production of successive species of animated beings, is still to be found in the principles of our modified philosophy; and that the tribe of zoophytes, or sea animals, resembling plants in their form, is still looked upon as the first link in the great animated chain. It will, therefore, not be considered unworthy of our attention, if we take a more extended view of the argument, and endeavour to show that such an arrangement in nature is not only derogatory in the highest degree from the Almighty power and wisdom, but completely at variance with a correct view of the animal kingdom. We find it correctly stated in the following extract from one of the most instructive and able works of our times, that the various tribes of zoophytes subsist upon the minute species of animalcula, so abundant in the sea as well as in all the other waters of the earth, and which have been called *infusoria*, from the well known circumstance that scarcely any vegetable substance can be infused in pure water, without, in a short time, exhibiting, under the microscope, myriads of such wonders of the creative power and wisdom. "Zoophytes appear to feed principally on infusoria, (or sea animalcula,) *and they required* ONLY *the existence of that class to prepare the sea for their creation.* Their remains form the oldest fossil animals met with in the strata of the earth."*

The latter part of this passage, from the pen of a learned professor, shows that its author directly pointed towards the above mentioned notion, grounded on French philosophy, although the case is not expressly stated in words; but, as in all similar doctrines of an unsound philosophy, this passage contains the antidote as well as the poison, for it fixes upon a class of animated beings as *food* for this *first link* of the animated chain, of all the wonders of creative wisdom, that which is, perhaps, best calculated to excite our most profound admiration.

That all created beings present to our admiring view a great chain of various parts, each link connected with its fellow by easy shades of similarity of structure, is a fact admitted by the most cursory student in this wonderful book. But what link of this chain is to be looked upon as less wonderful, or incomprehensible, in its origin, than another? And if, which it would be difficult to do, we can discover one more imperfect than another, for the performance of the great ends to which it is decreed, are we to fix upon this apparent imperfection as the first attempt and *failure* of the Almighty hand? The wonders displayed by the microscope ought for ever to obliterate from our minds any such impious and unworthy notions. That instrument exhibits to us the great fact, that if *perfection of design*, combined with what we consider *difficulty in formation*, is to be looked for in the creation, it is amongst the minutest of the insect tribe that we shall find displayed the most wonderful wisdom of the Creator. All that the most profound genius is capable of inventing, presents but a feeble image of the structure and actions of these minute creatures; and yet the tribe of zoophytes, as the most imperfect of created animals, "ONLY required the existence of the class infusoria to prepare the sea for their creation!" Such ideas of imperfection in the works of the Almighty, are quite unworthy of our enlightened times; and the streams of knowledge flow to little purpose, if the head-springs are tainted with such impurities.

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* Edinburgh Encyclopedia, vol. xviii. p. 843.

Our notions of the power of the Creator never can be more elevated than in contemplating the more minute portions of the animated chain, the wonders of which make it appear as if he wished to veil his most perfect works from human eyes, and to lavish them on beings the most obscure, and, in appearance, the most vile; for, according to our finite and imperfect ideas, there would be less difficulty (if we may so speak of the works of the Almighty,) in forming the large members of the whale, or of the elephant, than the delicate fibres and minute vessels of the gnat or of the spider. But as we *descend* in the scale of magnitude, we seem to *ascend* in that of perfection and incomprehensible difficulty; for by the aid of the microscope, we discover new wonders at every step of our investigations, and find that our unassisted vision can perceive but one half of the living beings which adorn the earth. The mind is lost in wonder, and is incapable of conceiving what the tongue can so easily express, that there are, in almost all fluids, animals as perfect as ourselves in bodily structure and action, so minute, that it would require *millions* of them to form the compass of one single grain of sea sand?* But when we thus arrive at the verge of power in our instruments, we have still no reason to conclude that we have reached the utmost limit of animated creation. Future instruments may possibly exhibit wonders as great as those we are now considering; and we thus find, as astronomers have done in the opposite extremity, that we can discover no bounds to creative power and wisdom.

It may also be remarked, that the balance of animal and vegetable productions is so admirably arranged, that the removal of any *one link* would serve to throw the whole chain into confusion. We come, then, in conclusion, to the same point from whence we at first set out, viz. that zoophytes could not exist without the animals on which they feed; and as the same may be concluded, with regard to any other individual species, that *all* must have been the spontaneous creation of an Almighty power, at one and the same period, and not a gradual production, by the *mere laws of nature.* We shall have a future opportunity of showing why zoophytes could not but be the earliest fossil productions found in the secondary strata of the earth.

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* The author has lately had an opportunity of demonstrating, in the most unequivocal manner, that it would require from *one* to *three millions* of some active animalcula to form the bulk of a grain of sand. This distinct measurement is made by means of a vegetable graduated fibre, accidentally discovered in a greenish scum on a gravel walk.

The supposed *chemical* process, however, which we were before considering, must have required a much longer period than the inspired writings have given us, to bring it to perfection. The *days* of the Mosaical history, (which history never could be entirely excluded from the minds of men,) with their *evenings* and their *mornings*, were, therefore, forced into the *indefinite periods* necessary for the operation.

Geologists, without any knowledge of the original text, and learned men, without any knowlege of geology, have, therefore, unintentionally formed a species of coalition, the effects of which strike deep into the very root of our confidence in Scripture, and sap the foundation on which our belief in the *Omnipotence* and *Omniscience* of an Almighty Creator ought to be founded.

With whatever pleasure and interest, then, we may follow the more plausible theories of *secondary* formations on the surface of the earth, it appears impossible for our reason to enter, even in the slightest degree, into the hypothetical systems taught by the highest scientific authorities with regard to *first formations.* We are taught, both by scripture and by our reason, that the earth, as but a small part of an immense sytem, was intended as a temporary abode for *immortal souls* in their *mortal bodies.* We have no reason to suppose that we are misled by history, when we are informed that but a very few thousands of years have elapsed since the creation of mankind: we are taught to believe, from what we read in a part of Scripture, which it is not so much the object of science to dispute, that a very considerable portion of the historical events of the world has already passed away, and, consequently, we may infer, that the scene on which we now act a part, will not be of *immense* duration. Now, in considering the laws by which events are brought about, and the changes of this world are effected, we never discover so great a disproportion between the *means* and the *end*, as would be the case, if we admit, with but two many geologists, that *millions of years* may have been necessary for the preparation and *ripening* of this earth from *chaos*, to fit it up as a stage on which so brief a drama was to be acted. This is one of the first difficulties our reason has to encounter in considering the *gradual* formation of the globe from secondary causes: but our difficulties are only then beginning, for even if we admit this theory, we do not, in the least degree, advance towards the object of our search; we are as far as ever removed from a GREAT FIRST CAUSE, to which our reason is as true as the magnet to its pole. We cannot close our eyes upon the great truth so deeply impressed upon our minds by every thing around us, that, even admitting a *chaos*, *that chaos must have been* CREATED in all its component parts. The chemist, in his laboratory, may compound the various substances and fluids, from the qualities of which he is aware that crystals will be formed; but he is obliged to exercise the knowledge acquired from study and experience, and to apply the heat necessary for their formation. Although he may thus form the compound, *can he create the materials of it?* Though he may produce crystals, *can he enact a law by which these beautiful forms shall be arranged?* No. The potter may *form* the vessel, but he cannot *create* the clay.

Amongst the many inextricable difficulties in which we become involved, by a departure from the guidance of the sacred record, and by supposing, with the continental philosophy, that the solid globe was a *chemical crystalline deposit* from an *aqueos* chaos, we have to overcome this certain fact in these *same laws of nature*, viz. that as we know of no other source of *heat*, and, consequently, of *fluidity* on our globe, and, probably, in the other members of the solar system, than *the sun;* as we know that there are parts of our planet around the poles where no water can exist in a fluid state, for the greater part, if not the whole of the year, from the absence of that sun's influence, nor, indeed, ever *could have existed* since the solar system was arranged; and as we know that without that *solar influence* no fluidity could exist on any part of the earth's surface, *by the mere laws of nature*, (as even mercury becomes solid at a higher temperature than exists at the poles,) how are we to suppose a *chaotic* AQUEOUS *fluid*, held together in empty space, and without the melting influence of a sun, which, consistently with this philosophy, we must conclude was not yet *precipitated* or *crystallized* into perfection within its own *chaos;* for if we adopt the chaotic principle, with regard to our own planet, we cannot, in fairness, refuse it to the other heavenly bodies.

In adopting *secondary causes*, then, or the theory of the formation of the earth by the *mere laws of nature* from an *aqueous chaos*, we must account for *fluidity* without *heat*, an *effect* without a *cause*, and directly opposed to all the known laws of nature.*

In advocating, then, the chaotic philosophy, we must account for the *creation* of the crude materials of which that chaos must have been composed, and also for those wonderful laws to which matter has been subjected, and by which it is forced to assume those crystalline forms which we so much admire; and being thus forced to acknowledge a *Creator* so wise and powerful as to be able to form *even a chaos* out of *nothing*, ("for if God did not create the first thing, then there is something besides Him that was never made, and then there are *two* Eternals,"*) we come to the consideration of his power to create things in a more *perfect* form. We find that created matter is divided into three kingdoms, as they have been called, of *animal*, *vegetable* and *mineral:* there are few who would now dispute that the first and second of these great divisions must have been at first formed in a perfect and mature state, although both have since been submitted to laws, through which they must pass from the embryo state to perfection. We cannot for a moment suppose the first man to have been once an infant, or the first oak tree to have sprung from an acorn, though all subsequent individuals, in both species, must now pass through these stages. If this perfection of form is admitted, then, in the first creation of the *animal* and *vegetable* world, are we to suppose that the *mineral* productions of the earth were exceptions from this rule? or that a Being so wise and so powerful as to be able to *create* a *man* or a *tree*, with all the wonderful contrivance and design discoverable in each, and above all, endued with a *living principle*, was yet obliged to form an *imperfect* mass, and to wait the fermenting or crystallizing process from which its more perfect form was to arise? The idea is revolting to reason; and when we have rejected it as *improbable*, as *impossible*, then comes inspiration, with its lofty and imposing simplicity, to assist our weak understandings, and to assure us that "in the beginning God *created* the heaven and the earth."

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* The greatest degree of natural cold that has hitherto been observed in the open air, is about 50 degrees below zero; but at the actual poles, and more especially at the south pole, which is surrounded by ice, and inaccessible by ships for upwards of 1000 miles on all sides, is, probably, at a much lower temperature. Mercury freezes at 39 degrees below zero, and then becomes malleable like any other metal. Thus, at the poles, *mercury* never could have existed in a fluid state, any more than *water;* and the strongest spirits are frozen at a still higher temperature.

"All substances in nature, as far as we know them, occur in one or other of three states; that of *solids*, of *liquids*, or of *elastic fluids*.

"In a vast number of cases the same substance is capable of assuming each of these states in succession. Thus, sulphur is usually solid, but at 218 degrees it becomes a liquid, and at 570 degrees it boils, and is converted into an elastic fluid. *Water is a liquid, but at 32 degrees it freezes into a solid*, while at 212 degrees it boils into an elastic fluid.

"All solids (a very few excepted) may be converted into liquids by heating them sufficiently; and *almost all liquids by cooling them sufficiently*, may be converted into *solids*. The law of nature then, is, that solids by heat are converted into liquids and elastic fluids; *while elastic fluids and liquids by cold are brought into the state of solids*."—*Edin. Encyclop. Chemistry*, p. 36.

"From what has been advanced respecting the situation, properties and manner of formation of the ice surrounding the pole, we may naturally conclude that *a continent of ice-mountains* may exist in regions near the pole, yet unexplored, the nucleus of which may be as ancient as the earth itself, and its increase derived from the sea and atmosphere combined."—*Scoresby's Arctic Reg.* vol. ii. p. 319.

Having, by this line of reasoning, come to the conclusion that the theory of a *chaos*, or imperfect formation of the earth, is not only contrary to our *reason*, but also in direct opposition to *history*, our belief in the truth of the inspired writings is strengthened and confirmed; and we feel equally disposed to question those theories of philosophy which account for the present appearances and stratifications on the earth's surface, by a numerous succession of *accidents* and *revolutions* which are supposed by some to have occurred previous to the creation or production of mankind, but subsequent to the earth's having assumed that perfect crystalline form we now discover in the primitive rocks. The demand for *time* is here again advanced by geologists, who support this theory of alternate revolutions; and as *time* is as nothing in *eternity*, they make whatever draughts they have occasion for upon this inexhaustible fund. It appears that history, as well as the consideration of the present course of things upon the earth, are equally considered as nothing in this philosophy. The minerals of the earth have been likened to coins stamped with unknown or difficult characters; and it is the business of the geologist, as of the antiquary, to decipher and arrange them in chronological order. But as it may safely be presumed that the antiquary would make little advance in his work, if he neglected to consult such histories as were within his reach, so we may come to the same conclusion with regard to the geologist. Ancient *coins*, *minerals* or *fossils* are all equally unintelligible, if we have no guide from history to lead us to an explanation of them.

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* LETTER FROM JEREMY TAYLOR, TO JOHN EVELYNE, ESQ.

"To your question, 'How it appears that God made all things out of nothing,' I answer, it is demonstrably certain, or else there is no God. For if there be a God, he is the one principle: but if he did not make the first thing, then there is something besides him that was never made, and then there are *two* Eternals. Now, if God made the first thing, he made it of nothing.

"Your obliged and affectionate servant,

"JEREMY TAYLOR."

In entering, then, upon our geological inquiries, it appears the more natural course to proceed upwards, from material things as they are now presented to our senses, to the First Great Cause, by which alone they could have been produced; and then, consulting such history as may be within our reach, to retrace our steps downwards, from the beginning of all things to the present time.* We may thus entertain a confident hope that all the appearances on the surface of the earth, upon which the theories of philosophy have been founded, may be accounted for by an *attentive* and *unprejudiced*, and above all, a *docile* consideration of the three great events recorded in history, viz. the *creation of the earth; the formation of a bed for the primitive sea, with the natural causes acting within that sea for upwards of sixteen centuries;* and, lastly, *the deluge*, with its crowd of corroborative witnesses, together with *the subsequent action of natural causes from that time to the present day*, or for upwards of four thousand years.

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* In the sixteenth century, the astronomer, John Kepler, of Wirtemburg, presented a work full of wild theory, to the great Tycho Brahe, who, after perusing it, returned it with the following advice:—"First, lay a solid foundation for your views by actual observation; and then, by ascending from these, strive to reach the causes of things." The whole philosophy of Bacon was thus compressed, by anticipation, into one short sentence.

With regard to the character of Moses himself, and the books of Scripture which were written by him, under the guidance of inspiration, by which alone he could have pronounced the remarkable prophecies which were afterwards so strictly fulfilled, it would not be to my purpose in this place to enter into discussion. It is enough to say that he is acknowledged by all as the most ancient historian whose works have come down to our times; and that the frequent notice taken of him by ancient writers, would serve to confirm the truth of his own narrative, even if *events foretold* did not vouch for his veracity.

If the great events thus recorded in the inspired writings, with all their necessary consequences, were as studiously adopted as foundations to build upon, as they have hitherto been studiously set aside in geology, we should soon find in all classes, ardent students in this most interesting science. But when an ordinary mind, anxiously searching after *truth*, finds itself launched into a sea of clouds and thick darkness, without star or compass as a guide, it must either desperately proceed from *doubt* to *infidelity*, under the guidance of *unassisted reason and philosophy*, or must give up the subject in despair of ever reaching the desired object; happy if it escape the too common taint of unbelief on points incomparably more important than geology. For if the Sacred Scriptures are the unerring dictates of divine inspiration, which prophecy so fully determines, we must consider them as *infallible* in *every* point. If, on the contrary, we find at the very threshold a statement *demonstrably* FALSE, we should have the strongest possible ground for refusing our belief to the subsequent history.

"Infidels have always imagined, and believers have too generally conceded, that the Mosaic account of the early ages of the world is the weakest of the outworks of Christianity. But, on the contrary, we may be persuaded that the firmest ground which even a philosophical believer can take, is the Mosaic record."—*Edin. Encyclop. Antediluvian.*

It is in vain we look for this line of reasoning in the works of those who are generally considered the great leaders in science. Both parties into which geologists have ranged themselves, the supporters of the theories of *fire* and of *water*, are equally opposed to the simple and unadorned narrative of the sacred historian; and both parties have, consequently, led themselves and their followers into an *inextricable maze* on the subject of *primitive formations*. It is, indeed, a melancholy proof, if any such were wanting, of the natural turpitude of the human mind, that notwithstanding the bright instances which have been and still are found in the opposite scale, so large a portion of those who search deepest into, and who ought, therefore, to be best acquainted with, the works of the Creator, have been so little inclined to give him the credit due to his omnipotence and wisdom, that *philosophy* and *scepticism* have been but too often and too justly looked upon as almost synonymous terms. What advances have been made in every branch of science and of arts since the days of Newton, and even since those of the great Linnæus! yet we do not always find a proportioned increase either in faith or in religious zeal. Any attempt to mix up science with religion has, indeed, been openly condemned by many able writers; yet the time, it is to be hoped, will come, when the Linnæan systems will be followed, as well in religion as in its union with the knowledge of the works of the Creator. The great and good Linnæus lost no opportunity of expatiating on the wisdom and goodness of the Almighty. In such expressions of admiration his breast seemed to glow with warmth, and he became truly eloquent.*

"Awake, upon the earth," exclaims he, "I have contemplated an immense, eternal, all-powerful, and omniscient God! I have seen him, and fallen prostrate in astonishment at his very shadow. I have sought out his steps in the midst of his creatures, even amongst the most imperceptible. What power! what wisdom! what inexpressible perfection! I have observed the animals nourished by vegetables; these, again, by earthly bodies; the earth rolling in its unalterable orb round the sun, the burning source of its life; the sun itself, turning on its axis, with the planets that surround it, forming, with the other stars, indefinite in number, an immense and boundless system. All is ruled by the Incomprehensible Prime Mover, the Being of Beings, as Aristotle has called him, the Cause of Causes, the Eternal Architect of his magnificent work."

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* This great naturalist and philosopher inscribed over the door of his lecture room at Upsal:

"Innocui vivite, Numen adest."

Even the heathen philosophers have set us an example on these great and important points, which the most humble Christians must acknowledge with admiration. "Do you call him *Fatality?* you are not wrong," says Seneca, "as every thing depends upon him. Do you prefer him under the name of *Nature?* you are right; all things are born from him. If you name him Providence, you are equally right; for by his orders and councils the world displays its wonders. He is all eye, all ear, all soul, all life; and human intellect is incapable of comprehending his immensity." "That Being," says the same heathen, "that Cause of Causes, without whom nothing exists, who has constructed and organized all things; who is every where present, and yet escapes our view; has veiled his August Majesty in a retreat so holy and impenetrable, that it is in *thought* alone that we can reach it.

In a beautiful hymn of Cleanthes, as preserved by Stobæus, we find the following sublime address to the Deity, under the title of Jupiter:

"O God, from whom all gifts descend, who sitteth in thick darkness, dispel all ignorance from the mind of man; deign to enlighten his soul, draw it to that eternal reason which serves as thy guide and support in the government of the world; so that, honoured with a portion of this light, we may, in our turn, be able to honour thee, by celebrating thy great works unceasingly in a hymn. This is the proper duty of man. For surely nothing can be more delightful to the inhabitants of the earth, than to celebrate that Divine Reason which presides over the world."

To such magnificent acknowledgments of a true God, by those whom we call heathens, we may add the beautiful creed of the great Pliny: "We must believe," says he, "that there exists an Eternal, Infinite, and Uncreated Divinity."

The light of day, however, begins to dawn upon this philosophic night; and there are many whose eyes begin to be opened, by the very excesses of hypothesis which have been promulgated by their scientific leaders. The great end of the study of geology ought to be, a *moral*, rather than a *scientific* one; the numerous practical and economical uses to be derived from it, should be, comparatively, subordinate, and would be fully gained in the course of the inquiry. The study carried on upon this principle in the present day, when science has made such rapid advances, as to have, as it were, shed a new light upon our benighted minds, would have the effect of settling our fluctuating opinions, which may have been shaken by the suggestions of a false philosophy. Let but a small portion of the brilliant talent be displayed on the science, viewed in this light, that has been expended and lost in hypothetical reasoning for the last half century, and we may confidently trust, that the coalition thus formed between *science and religion*, will bid defiance to the utmost efforts of infidelity and scepticism.*

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* It may be said of this, and of all other philosophical inquiries, as has been eloquently observed with regard to christianity: "It is delightful to have every doubt removed, by the positive proof of its truth; to feel that conviction of its certainty which infidelity can never impart to her votaries; and to perceive that assurance of the faith which is as superior in the hope which it communicates, as in the certainty on which it rests, to the cheerless and disquieting doubts of the unbelieving mind. Instead of being a mere prejudice of education, which may be easily shaken, belief, thus founded on reason, becomes fixed and immovable; and all the scoffing of the scorner, and speculations of the infidel, lie as lightly on the mind, or pass as imperceptibly over it, and make as little impression there, as the spray upon a rock."—*Keith's Evid. of Proph.* p. 4.

POSTSCRIPT.

Since this work was completed, the "Principles of Geology," by Mr. Lyell, have appeared; a work of very great talent, and full of interesting research and information on the *secondary causes* in constant action upon the earth. This able writer has, however, taken, in some respects, a new line of theory, and is as desirous of accounting for the phenomena on the surface of the earth, without the aid of any unusual or preternatural convulsion, as other geologists have been to press into their service a constant repetition of deluges and disasters. He sets out upon the principle of Playfair, "that amid all the revolutions of the globe, the economy of nature has been uniform, and her laws are the only things that have resisted the general movement. The rivers and the rocks, the seas and the continents, have changed in all their parts; but the laws which direct those changes, and the rules to which they are subject, have remained invariably the same."—*Title Page.*

Thus we find, that while Cuvier inculcates the doctrine of numerous deluges, alternately of salt and of fresh water, Mr. Lyell endeavours to account for all things without the aid of any general deluge, though he considers local deluges as amongst the ordinary occurrences of nature, and producing violent local effects. The Mosaic deluge appears to be looked upon either as a fable, or as a less general catastrophe, than it is usually conceived to have been; and, as a supporter of the Mosaic account of it, it is probable that I shall be classed among those "*physico-theological writers*," who, in the early days of science, wrote, it is true, but little worthy of saving them from the contempt with which they are here treated.

As may easily be conceived of a theory wherein all things are to be accounted for by the slow and gradual march of natural secondary causes, Mr. Lyell's system requires an unlimited period of time for its completion; and in tracing the errors into which other philosophers have fallen, he thinks there can be no wonder if such should be the case, when *hundreds* of years are often reckoned instead of *thousands*, and thousands instead of *millions*. Mr. Lyell accounts for the elevation of mountain ridges, by successive up-heavings of volcanic force, small in degree, but of frequent repetition; and, having time at command, he finds no difficulty in this process.

But notwithstanding this theoretical argument in the "Principles of Geology," so distinctly opposed by so many facts in nature; and, with regard to at least *one deluge*, so totally opposed to history, and the traditions of all nations, Mr. Lyell has taken a very learned and extended view of *secondary causes* and of *secondary formations*. On the evidences to be derived from the fossil remains of quadrupeds, however, he has encountered the same difficulties as professor Buckland, without having succeeded in throwing any greater degree of light on the obscurities of that subject. His mode of accounting for the remains of elephants in the icebergs of the polar seas, and for the other tropical remains of animals and vegetables over the temperate and polar regions, proceeds upon the same principle, and is open to the same glaring objections as the theories of Dr. Buckland and baron Cuvier.

With regard, however, to the actual age of the world, and the actually short period during which secondary causes have been in action on the portions of the globe we now inhabit, we may safely refer the subject to the powerful evidence produced in such abundance, and with so much industry, by this author himself. I have had occasion in a note, in another part of this treatise, (see Chapter V.) to notice the startling facts produced by Mr. Lyell, with respect to the quantity of mud *daily imported into the sea by the single river*, *the Ganges:* it is there admitted by Mr. Lyell, that even at *the lowest estimate*, viz. *one part in a hundred*, *of mud*, in the waters of that river, there is imported *daily* into the Bay of Bengal, "a mass more than equal in weight and bulk to the great pyramid of Egypt."* It does not suit the theory of Mr. Lyell to admit the correctness of major Rennell's estimate, in which it is shown, with much clearness, that the *daily deposit of that sin-*

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* Principles of Geology, vol. i. p. 284.

gle river, in the flood season, instead of only *once*, is nearly equal to SEVENTY-FOUR times the weight of that gigantic monument. If we even divide the difference between these two authors, and admit the amount to be not more than *than from thirty to forty times the size of the pyramid per day*, and if we extend our view of a similar action *to all the rivers of the earth*, and then consider the comparative actual extent of the whole mass of secondary formations over the surface of the primitive globe, we shall at once perceive that such violent transporting powers, acting *for a million of years*, must have produced a mass of secondary formations, infinitely greater than what actually exists upon the earth, which may, probably, be considered as of not greater medium thickness than about one mile. But one million of years is not sufficient for those who advocate the view of the subject adopted by Mr. Lyell; no author of that school has ever yet been able to bound his views within any nameable period; and we may, with much truth, transpose their own animadversion, and consider it as not very wonderful if they find themselves involved in inextricable confusion and difficulty, when they calculate upon *thousands* of years, instead of *hundreds*, and *millions* instead of *thousands*.

CHAPTER I.

Our ideas of the real extent of Objects on the Earth's Surface often erroneous.—True height of Mountains.—Depths of the Ocean.—Of Mines.—Of Volcanic Foci.—Eruptions of Mud containing Fish.—Volcanoes only in Secondary Formations.—True Scale on which to view the Earth.—Form of the Earth.—Newton's Demonstrations.—Gravity and Centrifugal Force.—False inferences drawn from Newton's Hypothesis.—True Primitive Creations.—Density of the Earth.—Reflections arising from the Subject.—The Days of Creation.

On entering on a subject so extensive as the consideration of the entire globe, and with the intention of first viewing it in a general way, before we proceed to the examination of its particular parts, our first object ought to be to attain the necessary elevation from whence this full and general view may be obtained.

Man, in his little sphere of action, on a minute portion of its surface, finds his ideas so confined, that he is constantly misled by them, in forming conceptions of objects beyond common, every day observation. Thus, when traversing the stupendous Alpine regions of the earth, the mind of a stranger is overcome with the unusual appearances of things; and it is in such scenes that the geologist but too often forms erroneous notions of the "*fracture* and *ruin of the solid crust of the earth.*"* In like manner, an idea of *immensity* is attached to the *fathomless abysses* of the great deep, or to the *profound sources* of volcanic fires. These objects, however, great as as they may appear in the common scale of human comparison, almost vanish when the larger and more correct scale, on which the whole globe has been framed, is applied to them. The entire diameter of the earth is computed at about 8000 miles. Now, the loftiest peak upon the earth's surface,* though it rises to the enormous elevation of upwards of *twenty-six thousand feet*, is but *five* such *miles* above the general surface of the ocean. In like manner, the greatest depths of the ocean sink into comparative insignificance, when this scale is applied to them. For although the actual measurement of these depths is, and ever must remain, beyond the reach of human art, yet we have the strongest reasons (almost amounting to certainty) for supposing, from analogy, that the form and surface of the bed of the sea have no greater variation from the general level than those of the surface of the dry land;† and, consequently, that while there may be depths in the ocean extending to four or five miles, by far the greater

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* "In the midst of such scenes, the geologist feels his mind invigorated; the magnitude of the appearances before him extinguishes all the little and contracted notions he may have formed in his closet; and he learns that it is only by visiting and studying these stupendous works, that he can form an adequate conception of the great relations

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of the crust of the globe, and of its mode of formation."—*Edinburgh Encyclopedia, Mineralogy.*

It has been well observed, that greatness is only a comparative quality. It is true, that Alpine scenery is well calculated to enlarge the mind, and to extinguish notions, formed on a more contracted view of the earth's surface. But even this enlarged view becomes contracted in its turn, unless the earth be viewed upon its own proper scale.

* Dhawalageri, in Asia. Mount Blanc is not quite three miles above the same level. On taking the mean height of twenty-nine of the greatest elevations in the Old World, it is found to be only one mile and three-quarters. The mean height of an equal number in the New World is nearly two miles above the level of the sea.

† We find it a general rule, probably without any material exception, that where a country is low, and the shore flat, the neighbouring sea is shallow in about the same proportion. On the contrary, where a coast is mountainous, and the cliffs high and precipitous, there we find the sea of very considerable depth, and nearly of the same form under water as above. We have this point ably illustrated in the survey of the German Ocean, with sections of the depths, in six different lines, from the shores of Great Britain to those of Holland, Denmark, and Norway, by Mr. Stevenson, in 1820. We come to the same conclusion on a small, but generally correct scale, by considering any fresh-water lake, the shores of which present a variety of scenery. In all the Swiss lakes it is very striking; and in some, where the immediate shores are of great elevation, the bottom of the lake has not yet been found.

portions of it, as of the dry land, do not vary more than from a few hundred feet to half a mile, from positive smoothness.*

The greatest depths that have ever been reached by actual soundings, have seldom exceeded one mile. Captain Parry, however, in latitude 57 degrees 4 minutes north, longitude 24 degrees 34 minutes west, and about one hundred leagues from any land, found no bottom with the deep sea clamms, and a line of 1020 fathoms, or one mile and 280 yards, being more than a quarter of a mile deeper than was reached by lord Mulgrave.

Mr. Scoresby sounded in latitude 75 degrees 50 minutes north, longitude 5 degrees 50 minutes west, with 1058 fathoms; and in latitude 76 degrees 30 minutes north, longitude 4 degrees 48 minutes west, with 1200 fathoms of line, or one mile and 640 yards, in neither instance finding the bottom. This last is, probably, the greatest depth of soundings ever attempted.

The deepest mines that man has yet been able to form, do not reach, in perpendicular depth, much beyond two hundred fathoms, or not more than about a quarter of a mile. M. Humboldt saw, in 1803, a mine, in Mexico, which was to be sunk to the great depth of 1685 feet, or 280 fathoms, and which was to require twelve years for its completion, which, however, appeared very doubtful.

In viewing even volcanic action on the same great scale by which we have measured the *mountains* and the *depths*, we cannot consider these awful phenomena of burning mountains as more than superficial *pustules* on the mere *skin* of the earth.

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* In the course of some late experiments at sea, on board H. M. sloop Trinculo, captain Booth, by order of the lords of the admiralty, in order to find soundings at unusual depths, Mr. Massey made use of several newly invented machines for this purpose.

He sunk a copper globe, capable of sustaining great pressure, with a line of 840 fathoms. The globe was enclosed in a strong net of cord, and was fixed close on the line, at about 40 fathoms from the lead. Neither globe nor lead returned to the surface; the globe had exploded, by the high pressure, and the line appeared as if blown off by an air-gun. A second globe was sunk, with a greater weight, and the same quantity of line, and it was inclosed in a still stronger netting, made of log-line, and not fixed so close to the line as in the former trial. In this instance the lead returned without having reached the bottom; but the globe had exploded, and the net was blown to pieces. These experiments proved, to the satisfaction of Mr. Massey and captain Booth, the impossibility of counteracting the effects of high pressure offered at great depths in the sea.

It is now pretty generally understood, and acknowledged, that *water* is one of the most active agents in the production of volcanic fires; and when we consider the number of volcanoes in the interior of our continents, which have, to all appearance, become extinct from the want of that communication with the waters of the sea, which obviously must, at one time, have existed; and that almost all the active volcanoes now known are situated near the sea coast, and rarely, or never, far in the interior of large continents, we have very great reason to conclude, that the utmost depths of volcanic action are not much, if at all, greater than those we have found reason to assign to the ocean itself, that is, from *one* to *five* miles.

Catopaxi, in South America, is, perhaps, of all volcanic mountains, the most distant from the sea; and yet it is only 140 miles from the shores of the Pacific. This remarkable volcano, which is nearly 19,000 feet above the level of the sea, presents us with a very strong corroboration of what has been said, that *water* is the great agent in volcanic action; and that the deepest source of this activity is not greater than has been above supposed. This volcano, from time to time, throws up, not only great quantities of *mud*, but also innumerable *fish*. The almost extinct volcano of Imbarbara, has also frequently thrown up fish in such quantities as to cause putrid exhalations over the whole neighbouring country. The species of fish thus thrown up, is that called by the natives of Quito, *permadilla;* it is about four inches in length, and is almost the only fish found in the lakes and waters of Quito: but the great numbers occasionally thrown out, give us reason to suppose that there must be very considerable subterraneous lakes in the calcareous caverns of that country in which these fish are bred, and from which the volcanic action of these mountains so far from the sea, is supplied with the necessary quantity of water. In this case we are certain, that those lakes cannot be at any very great depth below the general surface of the country, as the fish could not exist deprived of atmospheric air.

According to Humboldt, the volcanoes of America scarcely ever threw out *lava*; but chiefly slag, ashes, pumice, and vast quantities of *water* and *slime*. We consequently never hear of *burnings* in the tremendous eruptions of Quito, but only of overflowings of slimy mud. During the great earthquake of the 4th of February, 1797, 40,000 human beings were destroyed by the water and mud that issued from the mountains. In the description of the mud volcanoes in the island of Trinidad, given by Dr. Furguson, in the Edinburgh Transactions, one of the party who was examining them picked up *a white sea shell* of the turbinated kind, in the act of being thrown out along with the mud; a very sufficient proof of a subterraneous communication with the sea.

It has been remarked, that no known volcano is seated in *granite*, nor is it found near any volcano, except in very low situations. The same may be said of primitive rocks in general. The volcanic formation of Iceland is, probably, the most extensive in the world, covering a space of, at least, 60,000 square miles; yet there is no appearance of primitive rock in the whole of that island, though the mountains reach an elevation of nearly 6000 feet above the sea. One eruption of Ætna covered a space of fifty leagues in circumference, and one hundred and twenty feet in thickness, with calcareous sand or dust; and as calcareous earth enters very sparingly into the composition of what are considered primitive rocks, though it forms a large proportion of the secondary, we have thus another strong reason for supposing that volcanoes are not very deeply seated in the earth.

The whole volcanic formation of which Vesuvius forms the focus, reposes upon the secondary lime stone, of which the Appenine range is there formed. Of this we have various direct proofs, the most remarkable of which is the frequent projection of calcareous bodies from the crater, either in an unaltered, or in a modified state. When we connect this fact with the probable, and almost obvious communication with the waters of the neighbouring sea, we cannot but consider it as highly probable that the focus of this volcano is at a depth below the surface of the land, not much, if at all, greater than the thickness of the secondary strata, or the depth of the adjoining sea.

When we have thus reduced to their true and proper scale those objects on the earth's surface which we consider *greatest;* and when we further consider that the theories of philosophy on the formation of the *whole* earth, are formed on a view of the minute portions of its diameter to which we have access, these portions, not being more than, at the very utmost, *five miles in height*, and, by analogy, *five in depth*, out of 8000 *miles;* how trifling does the theorist appear with his cabinets of minerals on which his theories are founded. Let him cast his mind's eye along the diameter of a section of the globe, and say if he is justified in forming theories of the *mode of first formations* on so slight a view of its mere surface.*

Having thus corrected any false notions we may have formed, as to the comparative extent of objects within our view; and having thus attained the proper elevation from whence we may consider and study the globe *as a whole*, let us now proceed to an attentive and *unprejudiced* consideration of it, from the earliest times of which we have any record, and examine whether that record is *contradicted*, or *corroborated* by the appearances we may discover.

We find, then, that the most remote history opens with the assertion, that, "in the beginning God *created* the heaven and the earth; but the earth was *invisible* and *unfurnished*, and darkness was upon the face of the deep."

I shall here adopt the corrected translation of the Mosaic record, from the numerous authorities, and unanswerable arguments brought forward by Mr. Granville Penn, in his admirable work, entitled, the "*Comparative Estimate of the Mineral and Mosaical Geologies.*" That estimable writer has proved, in the most satisfactory manner, that the *tohu vabohu* of the Hebrew text, the '*without form and void*' of our translation, was uniformly translated, both by the Septuagint, and by the Jewish and Christian churches, for 600 years subsequent to the Septuagint translation by the terms *invisible,* (from being covered with the waters) and *unfurnished,* from having, as yet, no vegetation.*

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* It is not, perhaps, surprising, that the general views of mankind are, on such subjects, so very confined; for the globe itself is as much too large as the best artificial globes are too small for general use.

In order to obviate, in some degree, both objections, I have occasionally formed a section of the earth upon a flat sandy beach, upon the scale of one inch to a mile; and I have found that such a scale materially assists the mind, in correcting false judgments on this extensive subject. We have thus a circle of 8000 inches in diameter, or of 222 yards, which, when marked out with small stakes, upon a smooth surface, appears an immense area. Placing ourselves upon any part of this circumference, we have an opportunity of taking a just, though microscopic view of things as they are. The very highest mountain is, then, fully represented by five inches! the greatest depth of the ocean by the same little span! while we cannot calculate upon more than one inch as the medium variety of sea and land over the whole of this vast surface! In order to form an idea of smaller objects, we must examine an inch scale, finely graduated, and that, too, by the aid of a microscope; and we shall thus find, that man would occupy about the 880th part of an inch in his proudest stature, or about the size of the smallest animalcula observed in fluids!

It is one of the great triumphs of human intellect, that the globular form of the earth is proved to demonstration; and to this has been added, by the immortal Newton, the certain knowledge of that remarkable fact, that the globe is slightly flattened at the poles, and may, therefore, be termed rather an *obtuse spheroid,* than a *perfect sphere.*

This great and wise man, in considering the nature and origin of all things, has said, "it appears probable to me, that God, in the beginning, formed matter, in solid, massy, hard, impenetrable, and movable particles, of such sizes and figures, and with such other properties, and in such proportions to space, *as most conduced to the end for which he formed them.*

"All material things seemed to have been composed of the hard and solid particles above-mentioned, *variously associated in the first creation by the counsels of an intelligent agent.* For, it became him, who *created* them, to *set them in order;* and if he did so, *it is unphilosophical to seek for any other origin of this world,* or to pretend that it might rise out of *chaos* by the mere laws of nature; though, being once formed, it may continue by these laws for many ages."†

"When Newton had remarked, that the planets present to the sight figures of *obtuse spheroids,* and not of *perfect spheres;* when he had reflected upon the *nature* and *properties* of that particular figure, and had contemplated those orbs, as subjected in their revolutions to the opposing actions of *gravity* and *centrifugal force,* his penetrating mind at length discovered, that the *rule of harmony and equilibrium* between these two contending powers was only to be found in the figure of an *obtuse spheroid.*

"In order to render this fact plain to the understanding of others, he imagined this *hypothetical illustration.* '*If,*' said he, 'the earth were formed of an uniformly yielding substance, and *if* it were to become deprived of its motion, the law of *attraction* or *gravity*, acting equally, and without resistance, from all points of its surface, towards its centre, would cause that yielding substance to settle into the figure of a *perfect sphere.* But *if* it were then to receive a *transverse* impulse, causing it to revolve upon its axis, this new impulse would cause a *centrifugal* force, counteracting the force of gravity, by urging the particles, composing the yielding substance, *from the centre towards the circumference;* and thus would produce an alteration in the figure of the sphere. For this new force would tend to *elevate* the surface, and would have most power at the *equator*, and least at the *poles;* whereas, the opposite force of gravity would tend to *depress* the surface, and would have *most* power at the poles, and *least* at the equator. The result of this *inequality* of gravitation must necessarily be, that the original *sphere*, becoming elevated at the equator, but not at the poles, and the power by which this elevation was occasioned gradually diminishing from the equator to the poles, the figure would be eventually changed into that of an obtuse spheroid.'

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* Comp. Estim., vol. i. p. 173.

I must here acknowledge the very important services that have been rendered to science by this most able writer, who is the first that has clearly exhibited some of the most important, but obscure, truths of Scripture, in connection with physical facts, open to our examination. It is only to be regretted, that the necessarily controversial character of the comparative estimate, renders it a work more suited to the mind of the learned than of the general reader.

† Optics, Lib. 3.

"It being thus shown that such would be the necessary result of the compound power of gravity, and centrifugal force, it followed, that those two antagonist forces, acting at the same time in the earth, (SUPPOSING *it to have been formed of an uniformly yielding substance,*) would have worked themselves into *harmony* and *equilibrium*, by assuming that figure, which they would thenceforth maintain. Whereas, if we suppose the case of a *true sphere*, which should consist of a *solid* and *resisting* substance, the two opposing forces would act in perpetual and violent discord, with a constant tendency to *disunite* and rend the texture of the fabric. Now Newton having maintained that God, in the beginning, formed all material things, of such *figures* and properties as most conduced to the *end* for which he formed them; and having demonstrated that the property of an *obtuse spheroid* was that which most conduced to the *end* for which God formed the earth, viz. to revolve with regularity, and with perfect *harmony* in all its parts; he left it to the capacity of every one to draw the obvious inference, in conformity with his known principles, viz. that it is highly probable that God has formed the earth with the same figure, which it is manifest he has given to

Hutton, Playfair, and Cavendish, lead us to the same conclusions, which, *a priori*, we should have expected; viz. that the central parts of the earth abound with some species of heavy and solid matter; and as our inquiries, with regard to the *surface* of the globe, are in no way affected by the question of its interior structure, which will probably remain forever unknown to us; and as the above result is in no way contradictory, either to our *reason*, or to *history*, we may safely assume the *internal solidity* of the earth, as a fact, until stronger reasons are adduced in opposition to it.*

‡ to whom?

We have, then, presented to the mind, on the first day of the creation, and *created* out of *nothing*, by the incomprehensible power of the Almighty, a *solid mineral globe*, with its surface *invisible*‡ (from being covered with a thin coating of water, and there being as yet no light, for "darkness was upon the face of the deep.") And here, it is not without effort, that the mind is restrained within the limits to which our present inquiries must be confined. For when we consider that this great globe is but a small member of a stupendous *system;* and that even *that system* is lost in the immensity of other systems throughout boundless space, the apparent similarity of all which suggests the probability of each revolving sphere being destined to the same ends as our own;† the mind is overwhelmed with the extent of the prospect, and with our own incomparative insignificance, which would almost induce a doubt of the reality of those numerous blessings which we feel have been conferred upon us by our Maker. There is, indeed, nothing that so completely overwhelms the finite mind of man, as the discoveries which his genius and his reason have enabled him to make in astronomy; by which he finds, that, great as our solar system is, the immensity of space is filled with such systems, each moving in its own sphere, and all retained, in the most wonderful regularity and order, by the laws to which the Creator has submitted them. When we raise our thoughts, from our own little planet, to the contemplation of so boundless a creation, it is not without the utmost effort of the mind that we can connect *time*, and more especially a *short time*, with such immensity. But we must keep in mind, while dwelling on such subjects, that man's most erroneous notions *of creation*, arise from the necessity he experiences of connecting *length of time*, with *extent*, or *difficulty of operation in his own finite labours*. We must not forget that most of our great astronomical discoveries have been founded on our own earth, and its single satellite, as a base: and if, in the study of this earth, we find it revealed to us in the most unequivocal manner by history, and corroborated by physical facts, that our planet has not existed more than what *may appear to us* infinitely too short a time for the formation of so great and so perfect a body, we have no power to limit this discovery to an individual member of the solar system; we must extend it *to the whole*, upon the same principle of analogy on which so many astronomical discoveries have been *suggested*, and subsequently *demonstrated* to be true; our reason must bend, with whatever difficulty, to so conclusive a corollary. But this is a field much too wide for our finite comprehensions. We cannot proceed far on such inquiries as the present, without the conviction being pressed upon us, that "the ways of God are not as our ways, nor his thoughts as our thoughts." We feel the necessity of curbing our curiosity respecting the state of *other* planets, and of *other* systems; and we must be satisfied and thankful for the merciful dispensations it has pleased the Almighty to bestow so abundantly upon our own.

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* The terms so commonly used in geological writings, the *crust* of the earth, is but too well adapted to mislead the mind as to the true nature of the globe, which, as far as we know, or can understand, is solid throughout. The above term would seem to imply a mere outer shell, covering a hollow interior. Of the many false or problematical ideas of men, there is, perhaps, none more common or unfounded than that which attributes to the globe a hollow interior.

† We may say of the universe, what Pascal has so beautifully expressed of the immensity of God: "C'est un cercle infini, donc le centre est partout, et la circonference nulle part."

We must feel satisfied, however, from what history announces, and our reason corroborates, that not only our own earth, but the whole of our solar system, started into being at the same instant, and by the same incomprehensible and Almighty power; and that the laws by which the revolutions of the various members of our system are regulated and preserved, were enacted on this, the first day of the creation; when, though the sun had not yet actually *shone forth*, it yet produced the effect of light, and of the "*evening* and the *morning*," which "were the first day."

It is here scarcely necessary for us to dwell upon that most remarkable part of the first day's creation, the fiat that *light should appear*, as it has no very intimate connexion with the geology of the earth, and has been most justly admired by all who are capable of reading, or expounding the sacred volume. The remark, however, ought not to be omitted, that the distinct mention of the *evening* and the *morning*, forming each particular day, has always proved an insurmountable difficulty in the theories of a chaotic philosophy, which, in acknowledging the *days* of Scripture, though it assigns to them a much longer period of time than *one revolution of the earth on its axis*, has yet been unable to give any reasonable explanation of the terms *evening* and *morning*, as forming one day.* The idea of assigning *unlimited periods* to the *days of creation*, as recorded by Moses, has only arisen from the necessity of a longer period than 24 hours for the completion of so great a *chemical process* as the *supposed* production of the earth from *chaos*. But if first formations were not the consequence of a chemical process, which Newton considered most unphilosophical, and which our reason, and common sense most decidedly condemns, then the extension of the period *demanded* for their production becomes unnecessary.

It may here be objected, that if an Almighty power were able to create the universe in a *perfect state*, why should the work have occupied a period of six days? Why should not all things have started into being, as light is described to have done, *instantaneously?* The only answer that can be made to such objections, is simply, *that it was the will of God*, who, in his wisdom, appears to have had, in this, an ulterior *moral* view for the good of mankind, and for the commemoration of his own power and glory by his creatures. *Time* has accordingly been, by his express command, subdivided into *six* days of labour, and *one* of rest: and so much of the divine wisdom may be traced in this arrangement, that it has been generally admitted by the wisest men who have considered the subject, that no human ingenuity could improve upon it.

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* There is a very general traditionary notion amongst all nations, that darkness preceded light. In Otaheite, the natives consider that darkness was the origin of all things.

Aristotle says, "the theologians argue that all things sprung from darkness: philosophers say that all things were mingled together." —*Metaph. l.* 14. *c.* 6.

"As darkness preceded light, so the night of the Hebrew computation always preceded the day; thus in a manner perpetuating a commemoration of the transactions of the first day of the creation." —*Comparative Estimate.*

There is also a strong argument to be found in the divine command which establishes the hebdomadal division of time, against the theories which demand an extension for the *days* of the creation:—"Six *days* shalt thou labour, and do all that thou hast to do; but in the seventh *day* thou shall do no work; for in six *days* the Lord made *heaven* and *earth*, the *sea*, *and all that therein is*, and rested the seventh *day*; therefore remember this seventh *day*, to keep it holy." In this commandment the *days of creation*, and *working days of twenty-four hours*, are so completely identified in the sense and construction, that nothing but *that species of force*, so often resorted to by philosophy, in support of a week, but favourite theory, can separate them.

Now, a *creation* by an Almighty power may as easily be the work of one moment, as of a thousand years; and though the laws of *chemistry* are now found to produce crystals, under the hands of the chemist, the great mind, even of a Davy, has never yet produced either a *vegetable* or an *animal* formation; and there is, consequently, no ground for this demand for *time*, with respect to any of the Mosaic days on which *these* creations were first called into being. But we have no reason to suppose that there was any *variation* in the length of the Mosaical days, which are each defined in a manner so similar and distinct. We can, therefore, come to no other conclusion, than that the Mosaical days were such periods of 24 hours, as have ever since continued in succession, and will continue till "*time shall be no more.*"

CHAPTER II.

The Second Day of the Creation.—The Firmament, or Atmosphere.—Atmospheric Phenomena.—Magnetism, and Electricity.

We now come to the consideration of the second day of the creation, in which it pleased the Almighty to create, and set in order, the firmament, or atmosphere, by which the whole globe was to be surrounded.

"And God said, let there be a firmament in the midst of the waters; and let it divide the waters from the waters: and God made the firmament, and divided the waters which were under the firmament," (or upon the earth,) "from the waters which were above the firmament," (or in the clouds,) "and it was so."

It were as vain to inquire into the *mode* of the creation of the *atmospheric firmament*, or *firm support*, by which the whole globe is embraced, and, in a manner, *hermetically sealed*, as into that of *granite*, or of *water*. We have, therefore, nothing left us, but to receive the fact as recorded, as this is a part of our earth to which the principles of *crystallization* will not apply, and which the chaotic philosophy has not yet accounted for by *secondary causes*. It may be permitted to us, however, to form some idea of the state of the new earth at the termination of the "first day," and of the effects produced by the fiat of the second. We have already arrived at the conclusion, that as the "evening and the morning" had formed the "first day," the sun was already created, although nothing more than its *effects of light* had yet appeared. The power of the sun must now, however, have begun to act by those laws, by which it has ever since been regulated; and this power, acting upon the earth, with its watery envelope, must have produced the effect of a thick fog, which was now to be *evaporated*, and raised high into the new atmosphere, thus dividing "the waters which were under the firmament" from the aqueous vapours which were, from hence forward, to be suspended "above," (or in the higher parts of) "the firmament."

Although the consideration of the atmosphere does not, strictly speaking, come within the scope of a geological inquiry, yet it may not be altogether irrelevant to our subject to make a few observations, in this place, upon this highly important portion of creation, by the action of which the decomposition of a portion of the earth is continually proceeding, and, consequently, the materials for secondary formations are as constantly being produced.

The atmosphere, or firmament, is that elastic fluid which surrounds the earth, and encloses it on all sides. This fluid, so little understood by the ancients, has occupied much of the attention of modern philosophers, and has given birth to some of the most remarkable discoveries of modern science. Its *weight* was first ascertained by Galileo, and applied by Torricelli to explain the rise of water in pumps, and of mercury in the barometer. Its *elasticity* was accurately determined by Boyle; and the effects produced upon it, by heat and moisture, have been explained by Halley and Newton. That atmospheric air is a *heavy*, *compressible*, and *elastic* substance, has been proved by many simple and direct experiments; and, in consequence of its *weight*, the portion of it nearest the earth is compressed by the whole of the superincumbent mass, and it is thus much more dense in the lower, than in the upper regions.

The air, in the higher regions, therefore, must be extremely rare, from its elastic nature not being opposed by any pressure from above; and, in this state, it becomes gradually unfitted for the support of animal life, as has been painfully experienced by those adventurous travellers who have ascended the highest mountains. Some attempts have been made to calculate the height above the earth to which the atmosphere extends. If the density of air were uniform, it would be easy to ascertain this point, by means of the data placed within our reach, by the discovery of the barometer; and, upon this supposition, the height of the atmosphere would be found to be a little more than five miles. But as this is not the case, and as the air gradually diminishes in density, its utmost height must be much greater. From observations which have been made on the duration of the *twilight*, or reflected light which we enjoy from the sun, after that luminary has itself disappeared, and before he again rises, the atmosphere has been calculated to extend to about thirty-six miles above the surface of the earth; and it is even probable that it exceeds that elevation, which, though it appears great to us, is, in fact, not so, when compared with the diameter of the whole globe; and not more in proportion, than a few coats of varnish on a common artificial globe.

The atmosphere, then, is like a thin transparent veil around the earth, which multiplies and propagates the light of the sun, by an infinity of reflections; and it is by means of these that we enjoy day-light before the sun has risen, and after he has set. If the atmosphere did not exist, each point upon the earth's surface would only receive the light from the rays which fell upon it, direct from the sun. Wherever the sun did not actually *shine*, complete darkness would reign. On the tops of the highest mountains, it has been observed, that the sun's rays are so little reflected, that, when placed in the shade, one can see the stars at noon-day; and what appears *blue sky*, in the lower regions, seems there almost *black*.

It is upon the same principle of reflection of the rays of the sun, in our atmosphere, that we, and other inhabitants of the temperate and high latitudes, enjoy more of twilight, both in the evening and morning, than the inhabitants of tropical countries, where, as soon as the sun has set, and until he again rises, there is almost total darkness, except from the light of the moon and stars. Our longer twilight arises from the inclined position of the earth's axis, from which position the sun's rays not falling so vertically, as in tropical regions, pass through the atmosphere in a slanting direction, and, consequently, through a longer extent of air, and with a greater variety of reflections, thus producing light long after the sun has set, and before he has risen.

It is within the range of this firmament, that all the meteoric phenomena, in constant action around us, are generated. Rain, dew, hail, and snow, are all occasioned by moisture imbibed by the atmosphere, from the evaporation of the liquid portions of the earth's surface, and acted upon by various degrees of heat from the sun.

The winds, in all their various degrees, from the gentle zephyr to the raging storm, are all produced by the action of *heat* upon this elastic fluid: and when we consider that the mineral surface of the earth is constantly and violently acted upon by the circulation thus kept up by means of the atmosphere, we can have no difficulty in understanding how materially it must effect geological *secondary formations*.

Amongst the latest discoveries of science connected with the phenomena of this vital element, is the very intimate connexion now found to exist between *magnetism* and *electricity*. There is, perhaps, nothing in the whole range of natural phenomena which has excited more the admiration of mankind, and, at the same time, been obscured with more complete darkness than the principle of magnetism; and it may be considered as a distinct proof of the difficulty of the subject, to observe, that few have even been the theories produced in order to account for it. A ray of light has now, however, been shed upon the subject, by the discovery of a few remarkable facts; and it is probable that in a few years more the active mind of man may overcome this hitherto insuperable problem.*

On the second day, then, of the creation, this most vital part of the earth's system was ordained, and submitted to those laws which have ever since continued in action. The moisture exhaled from the newly created *waters*, by the newly created *sun*, was elevated from the surface of the globe, still hid under its watery covering, and was suspended in the higher regions of the firmament, to descend upon the future dry land in fruitful showers.

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* A most remarkable accident, which occurred on the 13th of April, 1832, has served to throw some light on the intimate connexion between electricity and magnetism. A gentleman and lady, whilst travelling in Worcestershire, on the hind box of their own carriage, were overtaken by a violent thunder-storm, and both were struck by the electric fluid so violently, that their lives were in great danger for some weeks afterwards. A minute and most interesting account of this accident and its effects, is given in the "London and Edinburgh Philosophical Magazine," for September, 1832. It is only necessary here to allude to these effects on the steel and iron work through which the electric fluid had passed in its course. It was found to have communicated a highly magnetic power to all these articles. The balance-wheel of the gentleman's watch was, amongst others, so highly magnetized, that it has since been mounted as a compass.

In further illustation of this most interesting subject, it has lately been discovered that a vivid spark of fire is produced on the sudden removal of a steel point from a powerful magnet. This effect is now exhibited in London, in the National Gallery of Science in the Strand.

The sun itself, however, was not yet made to appear through the clouds, although its light again produced a second morning, which, with its preceding evening, formed "*the second day.*"

CHAPTER III.

The gathering together of the Waters.—The Sublimity of this Fiat of the Creator not sufficiently understood.—The Transition Rocks.

We now come to the consideration of the events which took place on the third day of the creation, viz. "the gathering together of the waters unto one place," and the consequent appearance of the "dry land."

"And God said, let the waters under the heaven be gathered together unto one place, and let the dry land appear; and it was so."

And this great fiat of the Almighty was to produce the first great geological secondary formations which we find upon the earth's surface; and as the laws which were, in the course of time, to give rise to all the other secondary formations, were from this time forth to come into action, it will be necessary for us to give our utmost attention to the consideration of this great change upon the surface of the earth.

We have before remarked, that, during the first and second days of the creation, the earth must have presented to the view (had any human eye existed to look upon it,) a solid globe of spheroidal form, covered with a thin coat of aqueous fluid, and already revolving on its axis as a member of the solar system. We are fully authorized in coming to this latter conclusion, from the distinct mention made in the record, of the *days*, comprising, like our present days, the *evening* and the *morning*, with the darkness and the light following each other in regular succession. The sun, it is true, had not yet been made visibly to appear, or to shine through the, as yet, cloudy atmosphere; nor had the moon yet become visible, from an additional, and yet more interesting and remarkable reason, which of itself, ought to be looked upon as confirmative of this view; and that is, that supposing her to have been placed on the first day of the creation, (when we are to conclude that the whole solar system started into being,) in the relative situation as to the sun and the earth, which she has ever since held at that period of her course when we give her the title of a NEW *moon*, it was not *possible* she could have been seen from the earth "until the *third* evening of her revolution, according to *our* computation, which exactly answers to the *fourth* evening of the Mosaical days; our computation connecting the evening with the *preceding* day-light, but the Mosaical computation with the *succeeding* day-light:"* and on this very day, accordingly, and not till then, she was made to appear at sun-set, to rule, or lead on the night, as the sun was ordained to rule and conduct the day.

It was now the will of the Creator that the earth should no longer be "*invisible*" under its watery covering; and, accordingly, the command was given, that "the waters should be gathered together unto one place," that the "dry land" might appear. In considering this great event, it becomes a natural and fair question, as it has been left open to us by the record, as to *the mode* or means by which it must have taken place. The well-poised earth had already begun to revolve upon its axis; and the laws of gravitation and of fluids had consequently began to act in our system. By these laws, it was impossible that the waters could have been gathered together by accumulation, or above the general level, as the *solids* of the earth might have been. We can, therefore, come to no other conclusion than that to which we are also led by various parts of the inspired writings, viz. that God did "rend the depths by his intelligence," and formed a depression, or hollow, on a part of the solid globe, within which, by the appointed laws of fluids, the "depths" were "gathered together."

And here we should naturally feel disposed, if the inquiry could be expected to lead to any satisfactory result, to inquire how a hollow *could* be formed in so solid a mass as we must conceive the primitive earth to have been. But, in this inquiry, we should be adopting that very hypothetical reasoning which has so often led to error, and which we have already found such reason to condemn. The record is *distinct;* the *fact* of water requiring a *hollow bed* is *undeniable.* The means of forming that bed, we may safely refer to the hands of him who could *create* the ocean himself which it was to contain.* It were equally vain and futile to enter here upon the disputed points respecting the *solidity* or the *hollow nature* of the globe; because, when we apply to this bed of the ocean the true and proper scale by which we have already examined other parts of the earth's surface, we shall find the depression necessary for containing the whole waters of the earth, so very trifling compared with the globe itself, as not in any way to be affected by either side of such arguments; for we have found reason to conclude† that the very *deepest* abysses of the ocean are not more than from four to five miles below the level of its surface; and that the *mean* depth over the whole sea cannot be considered more than from a *few hundred feet* to *half a mile.*

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* Comp. Estim. vol. i. p. 230.

In considering, then, such comparatively diminutive depressions upon the earth's surface, it is by no means necessary either to imagine the "vast disruption and depression of the solid frame-work of the globe;" or to enter upon the question as to the *solid* or *cavous* state of the 7990 *miles* of its diameter, which must for ever remain concealed from our view.

The following beautiful reflections on this part of our subject are from the enlightened mind of Mr. Granville Penn, who may, indeed, be called the first great advocate for the Mosaic Geology, amongst the men of science of our day. "The briefness of this clause (Genesis i. 9,) and the nature of the subject, have caused it to be little contemplated in proportion to its importance, and to the fulness of the instruction which it conveys; and, therefore, it has not been observed that the same sublimity which is universally perceived in the clause, 'Let there be light, and there *was* light,' subsists equally in this clause; 'Let the waters be gathered together unto one place, and let the dry land be seen, and it was so.' The sentiment of sublimity in the former clause, results from the contemplation of an instantaneous transition of the universe from the profoundest darkness to the most splendid light, at the command of God. All men familiarly apprehend the *sadness* of the *former*, and the *delight* of the *latter;* and they are, therefore, instantly sensible of the glorious nature of the change which was then so suddenly produced. But the nature of the change which must necessarily have taken place, in *suddenly rendering visible* a part of a solid globe, the universal surface of which had been overflowed and concealed by a flood of waters, is not so familiarly or so instantly apprehended; the mind, therefore, does not care to dwell upon it, but is contented with receiving the general information *that the sea was formed.* Hence, both commentators and geologists have equally failed to draw the immediate and necessary inference from the revelation of *that great and undeniable geological fact.*"*

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* "He spake the word, and they were made: He commanded, and they were created.

"He hath made them fast for ever and ever: He hath given them a law which shall not be broken."—*Psalm* cxlviii.

† See chap. i. p. 42.

There is, besides, this further reason for our regarding the creation of light with more wonder and admiration than that of the "gathering together of the waters;" that however great and stupendous the latter operation must have been, it comes more easily within the scope of our intelligence than the former. We can imagine to ourselves secondary causes which could produce hollows in the surface of the earth, but the creation of light is far beyond the reach of our finite understandings. Although we can study its *effects*, and although science has made many brilliant discoveries with regard to these effects, yet we can in no way comprehend its *origin*. Its nature is beyond our reach: its *creation*, therefore, excites our admiration, in proportion to the difficulty we feel in comprehending it; but we are not, on this account, to form an erroneous estimate of the great operation which we are now to consider; for the formation of a *bed* for the ocean could be the work of that intelligence alone, which was able, at the first, to *create* that ocean.

This depression, small as it proves to be, compared with the diameter of the whole earth, was sufficiently deep and extensive to cause vast changes in the structure of a great part of the surface of the globe. In whatever *mode* the bed of the ocean was sunk, it is quite certain that the shores of the newly gathered waters must have been left in a rough, broken, and precipitous state. The descending portion of the solid earth, which was to form the bottom of the new sea, must have been subjected to extensive fracture and derangement, and must instantly have been acted upon by that continual movement, and circulation, which were then decreed, and have ever since been kept up, in the great body of the waters.* The *tides*, and the *currents*, these unceasing agents, would then commence their unwearied labours; and the immense *debris* of primitive rocks, would, by constant movement and friction, be reduced to the various stages in which they are now often found. From that day forth, the vapours exhaled from the waters by the heat of the sun, were to be converted into the various meteoric phenomena with which the firmament is charged. The clouds were to descend upon the now "dry land;" the rills, the brooks, the rivers, were now to begin their never ending courses, each charged with its load of moveable particles, destined to be deposited in the bed of the new sea. The sands, and gravels of the new shores, would then be unmixed with those various secondary, or shelly substances, we now find amongst them in such abundance. Their appearance would then be altogether *crystalline* and *primitive;* and the first strata arranged by the ocean on the granitic surface of the sea's bed, would naturally be formed of such substances, and without any vestige of animal bodies which had not then been created; and which, though soon afterwards "brought forth abundantly," could not, for a long time, have left their shelly remains in the abundance we have reason to know they subsequently did.†

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* Comp. Estim., vol. i. p. 212.

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* "The transition rocks include a considerable variety of earthy substances; but they are generally composed of the primitive rocks, reduced to a state of disintegration, apparently by a mechanical cause, and afterwards re-united into conglomerate masses, by some kind of cement, of an argillaceous or calcareous nature."—*Edin. Encyclop. Physical Geography*, p. 488.

† "No fossil remains have ever been found in what are termed the oldest formations. In the transition rocks," (the formation of some of which we are above considering,) "where they first occur, they are but very rare; yet in the newer" (or upper) "transition rocks they increase considerably in quantity. In the flœtz formations they continue increasing in quantity to the newer formations."—*Edin. Encyclop. Mineralogy*, p. 409.

In considering the fossil remains of shell fish, which are by far the most abundant of all fossils, we must remember that the accumulation of their shelly remains would be progressive. Those of the first generation, for instance, would exist through many generations of living fish; and at the end of a hundred generations, we should find nearly all the shells of these generations, though the numbers of living creatures were not increased from the first year. We can thus

If an opportunity, therefore, were given us for the examination, we should expect to find various strata composed of broken masses of primitive rocks, reposing upon these same rocks in their solid and unbroken condition. The opportunity *has* been placed within our reach, and *we do find* such strata as were to be anticipated, and to which, even the chaotic geology has given the name of *transition* or *fragmentary* formations; a name evidently suggested by their appearance and composition.

It is not my intention, in this place, to proceed with the consideration of the three last days of the creation, as recorded in the Mosaic history, because they do not present the same grounds for geological inquiry which are to be found in the operations of the first three days, which we have now been considering. We have seen that the *creation* of the primitive portions of the earth, that is, of *rock*, of *water*, and of the *aerial atmosphere* surrounding both, could have been effected only by the fiat of the Almighty architect of the universe. We have found no reason to cast a shadow of doubt upon the Mosaic record, where it informs us that the various parts of creation were produced in six separate and distinct days, which, from their *evenings*, and their *mornings*, must have each comprised *one* revolution of the globe upon its axis. On the contrary, we have seen, that the very remarkable coincidence of the first *visible appearance* of the moon, at the very time alone when she *could* have been first seen from the earth, (viz. on the third evening of her revolution,) affords us the strongest corroborative evidence of the truth of that part of the record. Since we have found reason to conclude, that, at the end of the third day, all those laws by which the earth was afterwards to be governed (excepting those of animated beings which had not yet been created,) had begun to act; that the various influences of the sun, and of the moon, were from this time forth to be in force; it now remains for us to proceed to the consideration of these laws, and of these influential causes; and to endeavour to discover whether they are not sufficient to produce many of the secondary appearances, so general over the whole surface of the earth.

easily and naturally account for the scarcity of fossil shells in the earlier formations, and for their progressive abundance in the subsequent ones.

CHAPTER IV.

Constant Changes in Nature.—Origin of Secondary Formations.—Primitive Soils, for the Nourishment of a Primitive Vegetation.—Constant Circulation in the Fluids of the Earth.—Springs, Brooks, and Rivers.—The Tides.—Their Cause Explained.—The Currents of the Ocean, and their present existing System.—Effects naturally arising from these powerful Causes.

Taken in a general sense, we may, perhaps not unaptly, liken our earth, surrounded with its atmosphere, to the various contents of a vessel hermetically sealed up, and kept in constant agitation. This continued movement would cause a constant change in the relative situation of every part of its contents. But the exact *number*, or *quantity*, would for ever remain the same. No extraneous substance could find admittance; no particle from within, could escape. Thus every created atom now contained within our atmosphere must have been so, under some form or other, "in the beginning."

It requires but a slight glance around us to perceive, that by the laws to which all things have been submitted by the Almighty, (to which we generally give the unmeaning name of the *laws of nature*,) matter is constantly assuming a different form. The stately oak moulders into dust, and becomes food for other plants. The ox changes grass into flesh; his flesh passes at his death into other beings, who, in their turn, undergo the same metamorphosis. All created beings move, without ceasing, from one form to another. Man himself, being laid in the earth, fertilizes the soil: his flesh becomes food for *plants*, which are eaten by animals, which man, in his turn, devours. His Creator has announced to him this

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great truth, "For dust thou art, and unto dust thou shalt return."* Even the most solid portions of the mineral world are not exempted from the influence of these laws. The primitive and solid granite, when acted upon by *cold*,† by *heat*, or by *moisture*, becomes slowly, but gradually decomposed. Its minute parts become detached, and are removed far from their parent rock, by the action of the running waters. Frequent movement rubs off their angles; they assume a new *form*; they are known by a new *name*; they become *sand* or *gravel*. In either of these new forms, they are hurried to the great deep, and add their mite to that immense treasury. The same currents in the ocean bring the same materials, until either the one becomes expended, or the other differently directed. A bed, or stratum, is formed, which, under certain circumstances, becomes hardened into *stone*. It again assumes a new form, and is again known by yet another name; it becomes the *free stone*, or conglomerate of geologists. Thus we may trace the materials of *secondary formations* to the decomposition of the *primitive creations*.

"The primitive rocks of Werner are the following, amounting to fourteen: granite, gneiss, micaceous schistus or mica slate, argillaceous schistus or clay slate, primitive limestone, primitive trap, including hornblend and greenstone, serpentine, porphyry, sienite, topaz rock, quartz rock, primitive flinty slate, white stone, and primitive gypsum.

"Some geologists consider this catalogue as too limited, and include jasper, hornstone, pitchstone, and puddingstone, in the number of primitive rocks. All these rocks, though some of them be occasionally found mingled or alternated in strata with each other, are *crystalline deposits*, and are absolutely without any trace of organic remains, either of plants or animals. All rocks not included in the foregoing catalogue (except those called *alluvial*) are termed *secondary*, because they are found to contain more or less of organic remains: but it has been observed that the four rocks found in immediate succession to the preceding fourteen do not contain organic remains of the same characters as the rest. For although they contain some shells common to those in immediate succession to them, they alone are found to contain *zoophytes*, a species of animal *which is considered as forming the first link in the chain of animated beings*, none of which are found in any of the succeeding rocks. Werner has called these four, *transition rocks*, as connecting the *primitive* with the newer or *flœtz* (flat) rocks, containing abundant fossil remains, but by others they are included in *secondary formations*."—*Phillips's Geology.*

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* "To say with Pythagoras, that the soul of a man can pass into the body of a bird, is to extend to a moral sense, this great truth in natural history. Nothing can be more contrary to reason or revelation than this idea; but, on the other hand, nothing is more certain, than that the alimentary matter of which a body is composed, is transformed into the flesh of the vulture that devours it.

† Mr. Scoresby, in his account of Spitzbergen, says, "the invariably broken state of the rocks," (upon a high mountain, the ascent of which he was attempting,) "appeared to be the effect of frost. No solid rock was met with, and no earth or soil. On calcareous rocks not impervious to moisture, the effect is such as might be expected; but how frost can operate on quartz, is not so easily understood.—*Arctic Regions*, vol. i. p. 122.

We have, in a former part of this treatise, considered the question of zoophytes being, as Mr. Phillips here states, "the *first link* in the chain of animated beings." It may now be sufficient in this place to point out, that as it is one part of the nature of zoophytes to inhabit the depths of the ocean, and there to become fixed, as plants are by the roots, without having it in their power, like the other inhabitants of the deep, to clear themselves from the sediments that are constantly being deposited, their remains are found in a fossil state, as we should naturally have anticipated, amongst the very earliest of these secondary strata, and before the remains of the testaceous animals could have accumulated in any great numbers.

The question then occurs, what were the primitive creations? and were they confined to the small number of rocks now considered as such by geologists? We feel quite satisfied that all the calcareous and secondary formations now known as such, did not exist in their present form in the beginning; because they contain the fossil remains of animals or vegetables which are often preserved in their most delicate parts, and which, consequently, must have been embedded at a period when these hard rocks were in the state of soft mud. But as the materials for the formation of these soft beds, must have originally been furnished from some primitive creation; and as a minute examination of them does not generally exhibit a crystalline appearance such as is supposed to characterize primitive rocks, it becomes a highly important consideration whether our present ideas of primitive creations are sufficiently extended. For example, what conclusion do we come to from a minute examination of the composition of *chalk*, which forms so extensive a portion of secondary formations? Its particles are of the finest earthy nature, and no appearance can be detected of any of the constituent parts of what are considered *primitive* rocks. In the finer sorts of clay we find the same smooth earthy character; and all limestone formations may perhaps be included in this remark. Some geologists have supposed that all limestone is as much an animal formation as *coral*.* This idea is probably unfounded; for if we can trace the formation of this extensive class of secondary rocks to the bed of the antediluvian ocean, we shall find reason to conclude that all these earthy formations, containing sea shells, must have been gradually formed by the accumulation of the finer particles of *primitive decomposition.*

Are we to suppose, then, at the end of the six days of the creation, when the new earth had been brought forth, adorned with "grass, and the herb yielding seed, and the fruit-tree yielding fruit after his kind," that all this vegetable world was nourished upon the *solid primitive rocks*, which in the present day are found to be utterly unfitted for vegetation? Are we to conclude that the same Almighty Power, which could create solid granite, together with all the varieties of the *vegetable world*, could not also provide the proper *soils* in which vegetables were to be nourished? No.—The idea would be worthy of that philosophy which imagines all things to have been at first in an *imperfect* state, and that their present order and beauty have gradually arisen *by the mere laws of nature.* It is more consistent with reason, as well as with the historical Record, to conclude, that as vegetables of every description were created *perfect*, there must have been *a soil* also created at the first, and suited to the nourishment of this new vegetable creation.

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* It is not a little remarkable, that in all the secondary rocks of Europe, although we have many, consisting of almost one mass of shells, we find none which we could suppose were formed by insects, in the same manner as the coral reefs are in the present seas of southern latitudes. The extent of the coral formation is truly remarkable. The great coral reef, on the east coast of New Holland, extends unbroken for 350 miles, forming, with others, more or less connected with it, a reef upwards of 1000 miles in length, and varying from 20 to 50 in breadth. As these reefs are known to be always founded in very deep water, they would form, if laid dry, a calcareous formation, before which many of our considerable mountain ridges would shrink in the comparison. We cannot, perhaps, find a more convincing argument in favour of the unchanged position of the axis and the poles of the earth since the creation, than in the total absence of coral reefs in the secondary formations of northern and temperate latitudes. Had the present poles of the earth been in the situation of the present equatorial regions, before the deluge, which is one of the prevailing arguments and sources of error and confusion in modern geology, we should certainly have found, in our secondary quarries, the petrified remains of former coral reefs.

The consideration of the component parts of the loose alluvial soils, and of their origin, has, in general, been set aside, or overlooked by geologists; and our present soils are so mixed up with decomposed animal and vegetable matter, that we cannot, from them, form a distinct idea of what they originally must have been. But if we deny that a *pure soil* must have existed from the very first, we adopt the doctrine of *secondary causes.* We must, in that case, suppose that vegetation began, and gradually proceeded in much the same manner as is observed on the lava thrown out by volcanoes; which, for many years after it has cooled, remains solid and totally *barren*, and which first admits of only the most minute species of mosses; but by the gradual decomposition and renewal of these, and by the atmospheric action upon the lava itself, a soil is gradually formed, which proves in the end extremely fertile.

We have before found reason, however, to come to a different conclusion. We have found, with Newton, "that it became Him who created all things, to set them in order; and if He did so, it is unphilosophical to seek for any other origin of things, or to pretend that they might have arisen, by the mere laws of nature."

We, therefore, conclude, that there must have been *a primitive soil* for the support of *a primitive vegetation;* that that soil must have been *loose* and *friable*, as at present, and subject, like the present soils, to continual movements by currents; and that it would, consequently, afford the *materials* for many of the secondary rocks, which geologists cannot otherwise account for.

I do not here propose entering into the mazes of hypothesis, by attempting to define what were the actual *primitive creations* in the mineral world; but as secondary formations must always have been in progress, (as they, even now, are going on) occasioned by the combined action of the atmosphere and the currents, their materials, however *earthy*, must have originally been *primitive;* and if a primitive vegetable creation required support from a primitive soil, we shall find, in the varieties to be naturally expected in such soils, a source for the variety we observe in the colour and grain of secondary rocks.

It may be demanded, what cause can be assigned for the variety in the colours of the different secondary formations? As well might a cause be sought for the varied colours of the primitive rocks, or the varied tints of the animal or vegetable world. When the colours of the tiger, the zebra, or the butterfly, are accounted for, we may hope for information as to the cause of chalk or Carrara marble being white, and other calcareous formations being of such variety of shades, down to the blackest marble. There can be no other reason given for such endless variety, but the *will* of a Beneficent Creator, who has thought fit thus to adorn his incomprehensible creation with innumerable objects, well fitted to convince the most sceptical mortal who will be at the pains to study them, that neither *accident*, nor the *laws of chemistry* alone, could have produced such admirable variety.

It has already been observed, that the currents in the waters of the earth are the great agents by which almost all secondary formations have been, and still are, carried on. In order to render this more plain to the intelligence, it will be necessary, in this place, to enter somewhat at large into the subject, and to trace the operations of nature now going on under our eyes.

It is certain, then, that there is a continual circulation kept up in the waters of the earth. The heat of the sun causes an immense evaporation from both sea and land. The vapours thus raised, become either *visible* or *invisible*, according to the degree of heat in the atmosphere; and thus, when cooled either by their contact with mountains, or by currents of cold air from the poles, they become condensed into drops, and fall upon the earth by their own weight, in the form of rain or snow. But although the supplies of rivers are very materially influenced by the moisture derived from the atmosphere, in the form of *rain* or *snow*, we must be convinced that a more steady and constant supply must be obtained from some other source; otherwise many rivers would become completely dried up during the summer months, when they are most wanted for the support of both animal and vegetable life.

This steady supply may be traced, in all hilly or mountainous countries, from whence streams generally flow, to the never failing *springs* invariably found, more or less, in such situations, and which have given rise to much discussion amongst philosophers, to account for such pure and copious streams, which are but little affected by the changes of wet or dry seasons of the year. It is to the action of the atmosphere alone that we must look for a solution of this problem. The day is gone by, when it was supposed that there was some internal communication between the sea, and the springs in the mountains, by means of which those pure and cooling fountains were kept in continual action. The whole process is now familiarly exhibited to our view in our every dining-rooms, by observing the effects of heated air on the surface of the cold caraffes upon our tables. It has been before explained, that a great quantity of moisture is absorbed by the atmosphere, from the surface of the waters of the earth, occasioned by the heat of the sun: this moisture is generally evaporated in an *invisible* form; but it nevertheless pervades, in a greater or less degree, every part of the atmosphere, and becomes visible in the form of clouds, when cooled by cold currents of air, or by contact with mountains, the surface of which is colder than the temperature of the surrounding atmosphere. But even in the finest and clearest weather, these watery vapours hover around us, in an invisible shape, and become condensed in the form of *dew* on the surface of rocks, or of plants, during the absence of the sun, and thus afford nourishment to vegetation even during the hottest weather.

But in the hilly and mountainous districts, these vapours are constantly, more or less, condensed upon the surface of the rocks or of the ground; and trickling down the sides and fissures, guided by the direction of the strata, they occasionally meet with obstructions through which they cannot pass, and are thus forced upwards to the surface, and break forth in the form of springs, which never cease to flow, because the source from which they are supplied can never cease to act.*

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* It is to this particular action of the atmosphere, when coming in contact with a lower temperature than its own, that we can often trace the cause of that dampness in our houses, which nothing can ever entirely obviate. Granite, whinstone, and some other rocks, are highly objectionable, as building materials, on account of their great coldness; and in houses built of such materials, one may always observe, in winter, on a change from frost to thaw, a dewy appearance

Every one is familiar with the effects of rain. A heavy fall upon the tops of the mountains detaches the various sized particles already loosened by the action of the atmosphere. They are hurried along by the little rills into the brooks, by the brooks into the rivers, and finally by the rivers into the sea, the waters of which are partially tinged with these turbid streams. Every river, in the whole earth, is more or less heavily charged with earthy matter, on its reaching the parent ocean. The *nature* and *colour* of this muddy mixture must depend upon those of the countries through which the rivers flow.

Having now traced the course of this earthy matter to the sea, it becomes necessary to observe in what way it is disposed of, in the bosom of the depths; and, for this purpose, we must consider the nature and action of this great body of waters. The continual influence of the moon, aided in a less powerful degree by the attraction also of the sun, is known to be the occasion of the *tides* which assist in keeping up the circulation of the waters.* But a much more power-

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standing thick upon the surface, and, in the end, running down in copious streams, like a violent perspiration. The common objection made to such stones, is, that they retain moisture, and perspire at certain times; this, however, is a vulgar error.

If a house be built upon a clay soil, the dampness, which is a usual consequence, does not arise so much from the clay being wet in itself, as from its great coldness, which condenses the warm air of the atmosphere, and thus forms a constant moisture. It is obvious, then, that sand stone, or brick, as a material, and a light sandy soil, as a foundation, must produce the most dry and healthy dwelling.

* The following clear description of the tides is given by Sir David Brewster, in his "Life of Sir Isaac Newton."

"One of the great subjects to which Newton applied the principles of attraction and gravity, was, the tides of the ocean. Philosophers of all ages had recognized the connection between the phenomena of the tides, and the position of the moon. That the moon is the principle cause of the tides is obvious, from the well known fact, that it is high water at any given place about the time when she is in the meridian of that place; and that the sun performs a secondary part in their production, is proved by the circumstance, that the highest, or spring tides, take place when the sun, the moon, and the earth, are all in a straight line; that is, when the force of the attraction of the sun conspires with that of the moon; and that the lowest, or neap tides, take place when lines drawn from the sun and moon to the earth, are at right angles to each other; that is, when the force of the attraction of the sun acts in opposition to that of the moon. But the most perplexing phenomenon in the tides, and one which is still a ful agent is continually at work in producing this effect; and as this agent, and its effects, do not come so familiarly within our view, its power is not so generally understood or acknowledged. This agent is the general system of the *currents* in the ocean.

These currents have long been remarked by voyagers in every part of the sea; and they have been found so powerful that vessels are constantly borne out of their course, unless due allowance be made for their influence. It was long supposed that these *rivers* in the ocean were occasioned by the action of the *tides:* but modern science and observation has proved this idea to have been unfounded; and has discovered that there is as regular a circulation in the great deep as in the veins of the human body. These currents chiefly arise from the following causes. In consequence of the powerful action of the sun in tropical climates, the loss by evaporation from the sea, is much greater than can be supplied by the quantity of rain which falls in these latitudes. The moisture thus imbibed by the atmosphere, passes into the regular circulation of the air; and when carried into the temperate or polar regions of the earth, it becomes condensed, and falls there in much greater quantity than these regions lose by evaporation. This superabundant supply of water cannot, from the figure and motion of the earth, remain where it falls, but rushes back towards the equator in currents, the directions of which must depend, in a great measure, on the

stumbling-block to persons slightly acquainted with the theory of attraction, is the existence of high water on the side furthest from the moon, at the same time as on the side next the moon. To maintain that the attraction of the moon at the same time draws the waters of the earth towards herself, and also draws them from the earth in an opposite direction, seems, at first sight, paradoxical. But the difficulty vanishes, when we consider the earth, (or rather the centre of the earth,) and the waters on each side of it, as three distinct bodies, placed at different distances from the moon, and, consequently, attracted with forces inversely proportioned to the squares of their distances. The waters nearest the moon will be much more powerfully attracted than the centre of the earth, and the centre of the earth more than the waters furthest from the moon. The consequence of this must be, that the waters nearest the moon will be drawn away from the centre of the earth, and will, consequently, rise from their level; while the earth will be drawn away from the waters opposite the moon, which will, as it were, be left behind, and be in the same situation as if raised from the earth in a direction opposite to that in which they are attracted by the moon."

forms of the coasts they may meet with in their course: and as no strong current can take place either in the air or in the waters, without a variety of eddies, or counter currents, as we familiarly know, on a small scale, by observing a strong stream in any river, or by the draughts of air in our houses; such are abundantly to be found in the ocean, and sometimes on so large a scale, and in such a direction, as might appear in opposition to the system above explained, unless the whole be viewed upon an enlarged scale. It has been supposed by some, that the winds, and especially the regular trade winds, have a great influence on the currents of the ocean, and may even be regarded as the cause of this constant motion in the waters. But this is taking too superficial a view of the subject. It is known that the currents of the *air* affect the *surface of the waters*, merely by contact and friction in the same manner as in the friction of any other two substances; and however the surface of the ocean may be agitated by this contact, and raised into waves by its force, we cannot suppose it capable of acting to any considerable depth, or of displacing large bodies of water. It is, indeed, understood, that though the swell of a wave advances on the surface, the water over which it moves remains nearly stationary; so that, although the winds may, in some small degree, aid or impede the *tides* or the *currents*, they cannot be considered *the cause* of the movement, any more in the one case than in the other. There appears to be a close resemblance between this circulation kept up in the waters, and that known to exist in the atmosphere. In the latter we have winds of various power and continuance, and also whirlwinds, occasioned, like the *whirlpools* in fluids, by the action of two contrary streams, or by the disturbance occasioned by an opposing object. There are also such decided *counter-currents* in the air, from the effort to preserve a just balance in that element, that it is a common practice with æronauts to send up a small balloon before launching their larger one, in order to discover in what direction the upper currents of the wind may be setting.

The whole system of the currents in the ocean can probably never be distinctly defined, on account of its great extent, and the very partial observations of voyagers. Besides, there must be a constant though slow alteration in the directions of their smaller divisions, according as the opposing objects are gradually worn away. But the general outline of the larger branches may be traced with tolerable distinctness, and may be here explained as they now exist in our own times. The present great system of currents, then, may be traced from the western coast of America across the Pacific ocean; of this current we as yet know little, but that it exists. But one branch of it strikes on the south of New Holland, running through Bass's Straits, round South Cape; and another branch runs amongst the islands of the Archipelago, on the north of New Holland. On entering the Indian ocean, and meeting the south polar current, it runs through the gulf of Bengal, round cape Comorin, and over to Africa, acquiring great velocity in its passage. From the straits of Babelmandel, it keeps always a south-west direction, till it doubles the Cape of Good Hope, when it turns to the north-west, following the line of the coast. On approaching the equator it sets nearly west. When in the latitude of three degrees north it meets with another current, which has run southerly along the west coast of Africa, with which it unites, and crosses the Atlantic, nearly W. S. W. On reaching the Brazils, it diverges at cape St. Augustine into two streams; one going S. W. parallel with the coast till it doubles Cape Horn, where it meets the south polar currents. The other part of this great Atlantic stream proceeds in a northerly direction through the gulf of Glandin, along the shores of the United States, where it is called the Gulf Stream, to Newfoundland; and here it is backed by the north polar currents; takes an easterly course across the Atlantic, coming over to the coast of Norway and the British Isles, and turning thence to the south, through the bay of Biscay, and along the coasts of Spain and Africa, meets the great southern current in the latitude of three degrees north. The breadth of the African branch of this magnificent *ocean river* is supposed to be from 150 to 1000 miles. At the Cape of Good Hope it runs at the rate of about two miles an hour; at the equator three and a half; and in the Gulf Stream four miles an hour.

It may easily be supposed what changes must be constantly taking place in the bed of the ocean, and on the shores of the dry land, by the never-ceasing action of these currents, the force of which is too powerful to be more than slightly affected by the action of the tides or the winds. There is, probably, a great re-action also below the surface, and at greater depths than our limited observations can penetrate.*

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* We may look for much interesting and useful information respecting the currents of the ocean, in a work now in course of

If such is the power and action of the currents and the tides in the earth, as it now is, we may safely conclude that they were not less active in the Antediluvian seas, the beds of which we now inhabit; having it thus in our power to examine the various strata of earthly *debris*, which, in the course of more than sixteen centuries, were deposited in various directions, according to the partial changes that must be constantly taking place in the direction of the currents, as the opposing points by which they are in a great degree guided, are worn away.

Having thus found one agent of sufficient power to remove vast quantities of mineral matter *from the land into the ocean*, and another, the effect of which is, gradually to arrange this matter in strata more or less horizontal, according to the form or slope of the primitive bed on which they are deposited, we can have little difficulty in accounting for most of the phenomena now discovered in the lower secondary formations of our earth. For the upper secondary formations and alluvial soils, we shall find a full and sufficient cause when we come to the consideration of the Mosaic deluge.

We must now resume the consideration of the primitive ocean from its first being "gathered together" until the Mosaic deluge, a period amounting to about 1656 years; and which will be found fully sufficient to account for many of the geological phenomena exposed to our view. For when we apply to the utmost depths of secondary formations, the scale on which we are now considering the *whole earth;* and also when we think of the great extent of decomposition and reformation incessantly proceeding in our own times, we shall feel satisfied that the *indefinite periods* assumed by the chaotic philosophy, are infinitely greater than the existing phenomena demand;* and we shall, consequently, have a more confirmed confidence in the truth of the inspired record.

publication, and written by the late Major Rennell. It is understood to apply, more particularly, to the currents of the Atlantic.

* See page 42, and note, page 71.

CHAPTER V.

General Nature of the Formations on the Earth.—Origin and Progress of Secondary Formations.—Causes of Stratification in Secondary Rocks.—Such Deposits become gradually Mineralized.—Calcareous Formations.—Salt Deposits.—Proof of Granite not being an Aqueous *Deposit.—Secondary Formations now in Progress in the Bed of the Ocean.*

The active researches of geologists into the existing phenomena on the surface of the earth, have led to the following conclusions with respect to mineral bodies.

"PRIMITIVE ROCKS

"Consist only of crystalline formations;
They contain no organic remains;
They are found below all other rocks;
And they rise from the base, through all other rocks, forming the summits of the most lofty mountains.

"TRANSITION AND FLOETZ, (or Secondary Rocks,)

"Consist partly of crystalline, partly of mechanical deposits;
They contain organic remains of sea shells;
And are never found under primitive rocks.

"ALLUVIAL DEPOSITS

"Consist of mechanical deposits;
They result from the ruin of rocks;
They contain abundance of shells, together with the bones of quadrupeds," and of the human race;
"And they are found above all the other rocks."*

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* Phillips's Geology.

Thus far the chaotic and the Mosaic geologies coincide; the facts are self-evident, and within the reach of every one who will take the trouble to examine them. But when the *causes* by which these facts have been produced, come under consideration, the two geologies separate; the one following the path which history has marked out, and which reason can comprehend, leading at every step towards the light of truth; the other, under a variety of leaders, plunges into the dark and devious mazes of hypothesis, rejects the guidance of history, and is led more and more into obscurity and error. There is no possible way of clearing this labyrinth and of gaining the desired end, but by retracing our steps and taking advantage of the clue which history affords us. But in doing this, we must keep constantly in mind the difficulties from which we have escaped; and the impossibility we have experienced of tracing *primitive effects* to *secondary causes. Truth* and *reason* acknowledge but one *primitive cause;* and that is, an *Almighty*, though to us, *incomprehensible* CREATOR.

Having found the arguments in favour of secondary causes, or the *mere laws of nature*, as they are called, totally insufficient to account satisfactorily to our reason, for the first formation of crystallized *mineral* bodies, any more than for the first formation of *animal* or *vegetable* bodies, we come to the unavoidable conclusion that they were all the *creative work* of an Almighty hand. But as it is evident that this creation, as soon as completed, was submitted to certain laws, by some of which a constant succession of decay and re-formation was to be kept up in the mineral world, at least as far as regards the mere surface of the earth, it may be considered quite within the scope of our reason to examine these laws, and to account for these secondary effects by secondary causes.

We find, then, that it is one constant law of the Creator that the action of the atmosphere shall decompose or break up the mineral bodies exposed to its influence. We find another called the law of *gravity*, by which the waters of the earth, in seeking their own level, are hurried from the highest mountains to the sea; carrying along with them abundance of mineral matter in the shape of *sand*, *mud* and *gravel.* We find a third law by which the waters of the ocean are kept in constant agitation; and the mineral matter imported by the rivers, is arranged in classes, according to the weight and volume of its parts, and distributed over the sea bed in various directions, and in various quantities, according to the nature of the currents which remove it.*

These three laws, which have been in constant action since the first creation of the seas, the rivers, and the atmosphere, which events, history informs us, took place about 6000 years ago, are fully sufficient to account for a prodigious accumulation of decomposed mineral matter in the bed of the ocean.†

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* This law of arrangement, which is founded on the law of gravity, may be looked upon as the great agent in distinct stratification. And as this law could not be in force without the lateral movement kept up by the currents of the ocean, we cannot look for its effects in situations where such constant action and re-action of currents do not exist. Thus we never can expect to find the secondary formations of fresh water lakes, however extensive, in the same stratified arrangement as in the bed of the sea. Whatever sand, mud, gravel or rock is lodged in a lake by rivers, must, therefore, remain exactly in the same irregular mass as when first imported and deposited; and, accordingly, we never find the shores of lakes, or the banks of rivers, presenting the same distinct classification as is always found, more or less, on the sea shores. For the same reason, we may be assured that in draining marshes or lakes, when we cut through distinct strata of sand, marl, gravel, or fine clay, which are all generally found in strata in such situations, we are to attribute such deposits, as well as their fossil contents, to a period when the action of the sea was in force; and that the hollow basin-like form which now causes a marsh or a lake, must have been at least partially coated with marine strata at the period of the deluge. We must, however, be guided by circumstances, in forming a judgment in such cases, as there can be no doubt that many places which were formerly shallow lakes or marshes, are now nearly dry, from the growth of peat, or the accumulation of the debris of land streams; and we must, consequently, judge of the nature of the soils, and of the period of the fossil deposits, according to their degree of stratification, and the nature of the embedding soils.

The remains of deer and other animals often found in peat mosses, must, therefore, be considered antediluvian, or, otherwise, according to the situation in which they occur, and according to the presence or absence of land streams, by the agency of which the deposits might have been made. The well known fossil elks of Ireland, and of the Isle of Man, may probably be regarded as truly antediluvian; though geologists have often considered them as much more modern.

† In a late publication by Mr. Lyell, which has come under my notice since the above was written, and which is a work full of information of the most important kind, with regard to natural secondary causes, which he considers sufficient to account for all the appearances on the surface of the earth, we find a calculation with respect to the quantity of mud lodged in the sea by the Ganges, which appears, as it is well calculated to do, to shake to its founda-

Should any event, then, take place to enable us to examine that bed *in a dry state*, we could feel no surprise if we should discover the original crystallized surface of the earth, loaded with various accumulations, resulting evidently from such decomposition of rocks as the atmosphere every where occasions, as the rivers every where become charged with, and as the currents of the ocean must, at all times, be depositing. As it is one part of the laws of gravity, that deposits in fluids shall fall to the bottom, in the same horizontal position in which these fluids themselves are retained by attraction, we should expect to find these deposits in this particular position; unless the irregular form of that part of the primitive earth on which they happened to be laid, occasioned an irregularity also in the deposited mass. Should any very considerable elevation or irregularity have existed on the primitive surface of the earth, such as we now denominate an Al-

tion the theory of the author; for it is obvious, that it proves too much to suit his idea of millions of years, as the age of the world. After stating the calculations of Rennell, and of Major Colebrooke, with respect to the waters of the Ganges, which are calculated to contain one part, in four, of mud, Mr. Lyell continues: "But, although we can readily believe the proportion of sediment in the waters of the Ganges to exceed that of any river in northern latitudes, we are somewhat staggered by the results to which we must arrive, if we compare the proportion of mud, as given by Rennell, with his computation of the quantity of water discharged, which latter is probably very correct. If it be true that the Ganges, in the flood-season, contains one part, in four, of mud, we shall then be obliged to suppose that there passes down, every four days, a quantity of mud, equal in volume to the water which is discharged in the course of twenty-four hours. If the mud be assumed to be equal to one half the specific gravity of granite, (it would, however, be more,) the weight of matter *daily* carried down in the flood season, would be about equal to 74 times the weight of the Great Pyramid of Egypt. Even if it could be proved that the turbid waters of the Ganges contain one part in a *hundred* of mud, which is possible, and which is affirmed to be the case in regard to the Rhine, we should be brought to the extraordinary conclusion, that there passes down, every day, into the Bay of Bengal, a mass more than equal in weight and bulk to the Great Pyramid."—*Principles of Geology*, vol. i. page 284.

Let the candour of this very able author calculate this effect over the whole earth for 2000 years, and then consider it as having acted for one or two *millions* of years; and let him say which result bears the most just proportion to the secondary formations actually found to load the primitive surface of the earth.

pine height, but at the bottom of the primitive sea, we should expect to discover the various horizontal deposits of various changing currents laid one above another, towards its top. If this top had been of sufficient elevation to be above the surface of the waters in the form of an island, we should not look for any such deposits above the level which the waters had reached; but, on the contrary, we should expect to find the bare primitive rock free from all secondary formation.*

After taking this general view of the bed of a former ocean, supposing it to be within our power to do so, we should naturally enter upon a more minute examination of the various mineral masses of which these deposits were formed.† And here we should soon find that the laws by which the world is governed, are not confined to those three, by the action of which these deposits have been formed. We should have to consult the voluminous code of *chemical laws*, the *foundations* of which, like those of all the other laws of God, are beyond our comprehension; but in the *action* of which, human science has made so many brilliant discoveries. We should every where discover effects produced by these chemical laws, varying according to the situation, and the nature of the materials to be acted upon. Instead of finding these materials, when freed from the waters in which they had been deposited, simply in the state of dry sand, mud, or gravel, and equally loose and friable as they must have been at the period of their deposition, we should find them cemented together in the most solid and compact manner. All the intervening spaces between the angles of the grosser particles, filled up with a stony matter, and the whole assuming the appearance and qualities of solid rock.*

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* "Of the nature of the bed of the ocean we know but little. The portions of it which have been explored by soundings, are found, in one place, to contain immense collections of the wreck of testaceous animals, intermixed with sand or gravel; and in another, to consist of soft alluvial mud, several feet in depth. Donati found the bottom of the Adriatic to be composed of a compact bed of shells, not less than a hundred feet in thickness."—*Edin. Encyclop. Physical Geography*, p. 518.

It was likewise discovered, in the researches of Donati, that, at a very few feet below the surface of the bed of the Adriatic, the deposits were converted, by pressure, and by the actions of the chemical laws of nature, into solid marble, and the shells completely petrified.

† "Various marine substances are to be found almost in every part of the extensive province of Chili, and even on the tops of some of its lofty mountains. In the main ridge of the Andes, the internal structure consists of primitive rocks of granite and quartz. The maritime and midland mountains, together with the lateral chains of the Andes, are of secondary formation; their strata, which are horizontal, and of unequal thickness, abound with marine productions, and contain the impressions of animal bodies."—*Molina's Natural and Civil History of Chili.*

Where cavities had, by any accident, been formed, either in the first deposition, or, as would be more probable, in the course of desiccation, we should frequently find that wonderful and unaccountable law in operation, by which fluids assume, in drying, a crystalline form. As the primitive ocean had, by the command of the Almighty, produced, "abundantly the moving creature that hath life;" and as many of these creatures were destined to become the permanent inhabitants of the deep, we should feel no surprise, in every where discovering more or less of animal remains, mixed up with the mineral deposits of their own proper element. But as the fish of the sea, as well as the fowls of the air, and the beasts of the field, are guided by the laws of *instinct* for their self-preservation; and as instinctive self-preservation would lead them, when alive, to keep upon the *surface* of these gradually forming deposites, unless when overpowered or buried by any unusual accumulation, we should seldom expect to find more than the shelly remains of the crustaceous animals.[*] Even these would be looked for, but in small numbers, in the first marine deposits; and they would afterwards be found gradually more abundant, as the bed of the sea became more loaded with the remains of past generations.[†] We could have little expectation of discovering the remains of *fish*, and still less, those of *quadrupeds*, in these gradually formed sea deposites; for though race after race, of the finny tribes, must have perished from the very first, and the bodies of many land animals, and even of human beings, must have been conveyed to the ocean, in the common course of events, before the flood; yet, that wonderful law of God, by which so just a balance is preserved throughout the animal creation, would have prevented almost a possibility of the remains of the dead being covered up, or preserved: for no sooner does a fish perish, than its body disappears among the voracious tribes of the deep; and those+ of terrestrial animals could rarely meet with any other fate.[‡] + bones & all

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* We are sometimes enabled to form some idea of the operations in the great laboratory of nature, and can thus trace, in some remarkable instances, the action of this petrifying power. One of the most remarkable of these instances is described by Mr. Morier as existing in Persia, not far from Maragha. A mineral spring issues from the earth in bubbles, and falls into a basin of about 15 feet in diameter. On flowing over the edges of this basin, the water spreads over the ground, forming numerous ponds and plashes, and in these it becomes hard, and produces that beautiful transparent stone, commonly called Tabreez marble. "The process of petrifaction," says Mr. Morier, "may be traced from its first beginning to its termination. In one part, the water is clear; in a second, it appears thicker, and stagnant; in a third, quite black; and, in the last stage, it is white, like hoar frost. The petrified ponds look like frozen water; a stone slightly thrown upon them breaks the crust, and the black water exudes. But where the operation is complete, a man may walk upon the surface without wetting his shoes. A section of the stony mass appears like sheets of rough paper, in accumulated layers. Such is the constant tendency of this water to become stone, that the bubbles become hard, as if, by a stroke of magic, they had been arrested, and metamorphosed into marble." Instances nearly as remarkable, are seen at the falls of Terni in Italy, at the famous hot springs in Iceland, in Derbyshire, and in many other places.

"I saw," says Saussure, "on the sea shore, near the Pharo de Messina, sands which were loose and friable, when lodged by the waves on the shore, but which, by means of the calcareous juice infiltrated into them by the sea, gradually becomes so hard, as to be used as millstones. This process takes place in the course of a very few years."—*Comp. Estim.* vol. ii. p. 45.

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[*] In the course of considerable experience in the search of fossil shells in various secondary formations, I have been led to the conclusion that these fossil remains must, in by far the greater number of cases, have been embedded after the death of the fish that inhabited them. The chalk formation is especially remarkable for the perfect state of preservation in which it renders up its fossil treasures; and they are often found retaining the remains of their most delicate parts, as perfect as when first embedded. In the case of the echini, for example, many of which are, in the natural state, covered with spines, like a hedgehog, I have found, in a few of the most perfect fossil specimens, just sufficient indication of a spine, to convince me how complete they would have been, had they been buried in a living state. But as they are almost always, more or less, stripped of their spines, it appears certain that they must have been exposed to the friction of the waters, in an empty state, before they were covered up. The fractured and disordered position of fossils in general, also tend to the same opinion. ✓

[†] See page 55, note.

[‡] Fish are rarely found in a fossil state in the lower secondary

On a closer inspection of some of the finer earthy deposits, having every appearance of having once been a tenacious mud, we should find them variously loaded with these crustaceous remains. We should also find, that the whole mass had become impregnated with a *calcareous quality*, which was not to be found in any of the formations generally considered primitive; and which, therefore, must have been acquired by some of those chemical laws at all times in action in the world. We should find some difficulty in coming to any positive conclusion with respect to the original *cause* of this calcareous property; more especially, when we discover a similar calcareous principle in the shells and bones of both terrestrial and marine animals.*

The deposits of salt which we might discover, would, in no way, surprise us, having had connexion with waters of the same briny character. But the question, whether the saltness of the ocean be *derived from the mineral*, or *the mineral be a chemical deposit from the water*, would probably lead us out of the plain beaten track we had determined to pursue, and should, therefore, be declined, and left for future investigation, as not in any way affecting the general question.†

In the whole of this general review of the secondary formations, however, we should be deeply impressed with this remarkable fact, that in all these various formations, in which

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formations; but the fact occasionally occurs, as might be expected, as exceptions to what may be called a general rule. They are, however, found in great abundance in diluvial formations, as we shall have occasion to perceive, in considering the effects of the deluge.

* "The component parts of bones are chiefly four; namely, *earthy salts*, fat, gelatine, and cartilage. The earthy salts are four in number, 1st. Phosphate of lime, which constitutes by far the greater part of the whole. 2d. Carbonate of lime. 3d. Phosphate of magnesia. 4th. Sulphate of lime."—*Edin. Encyclop. Chemistry*, p. 138.

"Lime has been known from the remotest ages. It abounds in every part of the earth, constituting immense ranges of rocks and mountains. It may be obtained by burning calcareous spars, and certain marbles. Oyster shells, when burnt, yield it nearly pure."—*Ibid.* p. 45.

† The saline principle so generally found in all animal productions, would incline us to refer all saltness to the great laboratory of nature, and not to attribute it solely to marine origin. With regard to salt, as a solid mineral body, I shall have occasion to make some remarks upon it, in a subsequent chapter. [See chap. 8.)

the laws of chemistry had been observed to have acted so powerfully, and in some of which even crystallization appeared, in many cases, to have taken place, we should discover no trace of such formations as we had previously remarked in primitive rocks, *which we had been taught to believe were originally crystallized in an aqueous fluid of the very self same character.*

We should no where find *granite*, or any other *primitive rock*, amongst the *secondary chemical deposits;* and we should consider this fact alone, as a positive confirmation of the conclusion we had before come to by a different process, viz. that the *primitive creations never could have arisen in an aqueous fluid*, by *the mere laws of nature.*

It is scarcely necessary to observe, that the case which has been here put hypothetically, of having it in our power to make this actual survey of the bed of the former ocean, has in fact occurred; as is sufficiently testified by the numerous phenomena presented to us, over nearly the whole surface of the present dry land.

But in order to form a more defined idea of the *mode* of secondary formations, let us, for a moment, consider the action of these same laws by which we have supposed them to have been formed, as they may, at any time, be observed going on under our eyes. Let us station ourselves on a part of the sea coast, near the mouth of any great river, and consider how the laws of *nature* are continually acting. We must, however, in the absence of extensive primitive coasts, which are now scarcely any where to be found, content ourselves with illustrations from the secondary and alluvial formations with which our present shores are loaded; so that the secondary deposits, now in progress, are formed from secondary rocks, instead of from primitive, as the antediluvian deposits must have been.

Let us station ourselves, for instance, on that point of our own shores, formed by the Isle of Thanet, where we have, to the south, a great extent of chalky coast, and to the north, the mouth of our noble Thames. And, first, let us observe the action of the atmosphere on the chalky cliffs of this island. There are few of the secondary formations more easily affected than the chalk, by the alternate moisture and dryness of our climate: and this is materially assisted by the chemical action of the salt from the spray of the sea. In the spring of the year, when the heat of the sun becomes powerful, and evaporates the abundant moisture imbibed by the chalk during the winter, the whole surface of the cliff, as it were, exfoliates; and large masses, becoming detached, are precipitated on the sands below, in a crumbling heap of ruin. The very first succeeding tide that flows, begins the work of transportation; and the waters retire, on the ebb tide, loaded with the finest particles of this chalky ruin. But though this insatiable enemy retires white with its booty, and sullies, for a considerable distance, the purity of the ocean, yet, on every succeeding flow, it again advances empty handed: the flowing waves are as transparent as if no chalk existed on the whole coast. A few weeks or months of this never-ceasing action gradually diminishes even the most solid portions of the chalk; and, at length, the sands are as pure and as free from earthy matter, as if no fall had ever taken place. Now, though we may liken this gradual disappearance of the chalk to that of salt or sugar immersed in water, there is this most material difference; that in the one case, the matter is actually dissolved, and held in solution as long as the moisture continues; but in the other, the indissoluble earthy particles of the chalk are carried off bodily by the waves; and are only held in *suspension*, until, by their own weight, they sink to the bottom of the sea, and are added, in the form of *mud*, to beds that must have been in the course of formation ever since that great revolution which placed the chalky bottom of the antediluvian sea in a situation to be thus acted upon as the high coast of the postdiluvian ocean.*

It is not so easy to determine in what part of the bed of the sea this chalky mud is now being deposited; but there is considerable reason to suppose that it is not in the immediate neighbourhood of the present shores: for there, the currents seem to deposit *sand* in such immense quantities, as to render the navigation both difficult and dangerous. We no where hear of a *muddy* bottom: every thing is either *sand* or *solid chalk*. And here we have numerous examples of the changes that are gradually effected in the form and structure of the bed of the ocean. Every old pilot, well acquainted with the difficult navigation of this part of the coast, can relate instances, within his own memory, where the shifting nature of the sand banks renders the most watchful attention to the landmarks and buoys so necessary. The form and extent of the fatal Goodwin sands have undergone considerable changes within a comparatively short period of time. They now extend many miles in length, and are formed of so pure a sand, that scarcely a shell is to be found upon them, and no gravel whatever. The ramifications of this bank, extending northward towards the mouth of the Thames, are all formed of an equally pure sand, which is dry and hard at low water.* Now, as all this sand is a *primitive crystalline formation*, having no mixture of calcareous earths, except, perhaps, particles of broken sea shells, in small quantity, we must conclude, that it is brought from other parts, by the currents, and that the lighter and finer muddy deposits, which are not found so commonly on that coast, are carried off and deposited in some of the depths of the ocean.

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* There cannot exist a doubt, that, though England be now separated from France by a distance of from 20 to 40 miles, and that distance be now occupied by the sea, the whole intervening space, and a great extent of both countries, form one continuous secondary formation of chalk, of which the basins of Paris, London, and the Isle of Wight, so well known to geologists, form a part. It is the opinion of some, whose ideas in geology are quite unfettered by history, as to time, that the two countries were once united, and that the separation has been effected by gradual decay, from the action of the sea upon a narrow isthmus. But history will not bear us out in this idea; for we know, from certain landmarks, which existed many centuries ago, such as the Roman part of Dover Castle, and other ancient buildings on the coast, that the decay of the cliffs, though constant and gradual, has not been such, in the last 2000 years, as to warrant any such conclusion, supposing the deluge to have taken place, as we have reason to know it did, about 4000 years ago.

Wherever these secondary formations may be in the act of deposition, we could feel no surprise, if, on examining them in a dry and hard state, we should discover, embedded in them, the shells of such crustaceous animals as may inhabit these depths; and if we should even find the remains of fish, or "creeping thing," with which we were unacquainted, we should not feel justified in concluding that they were not the inhabitants of our present seas, or not of existing species, because our research had not yet penetrated their deep abodes. For we may rest assured, that however minutely we may scan the dry land, and its various productions, there are treasures in the great deep, that are for ever placed far beyond the eye of the most active naturalist.

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* It is traditionally reported, that this formidable sand bank, in which the wreck of many a tall ship has been buried, was once a cultivated island, and part of the property of the Earl of Godwin.

The ancient Roman castle of Richborough, about a mile north of Sandwich, was once a sea port, though it is now fully two miles from the shore.. At that period, the Isle of Thanet was really an island, being separated from the main land by a channel, at one end of which was Richborough, and at the other Reculvers, both Roman stations, under the names of Ritupium and Rigulbium. In the Romney Marsh, on the south coast of Kent, there was another Roman port, which is now several miles from the shore.

But let us now turn our thoughts towards the flowing Thames, and observe the continual operations carried on by its unwearied waters. We shall find them charged with a load of earthy matter, collected, in their course, from the various formations through which the river flows. This burden must necessarily be of the most indiscriminate character; but these various bodies are to be deposited in an element where each species of importation is most exactly sifted, and every thing is arranged according to its own particular class. The *muddy*, the *sandy*, or the *gravelly* bodies, which are thus in constant motion downwards, from the highest sources of the river, are all at length submitted to the action of those *laws of* NATURE, which regulate the deep. We cannot suppose that all this earthy matter remains in the form of banks and shoals, near the immediate mouth of the river itself; for if this were the case, that mouth must long since have been completely blocked up. But, although we always find rivers closed, more or less, with a *bar*, occasioned by the contending action of the tide, and the stream; yet we do not perceive that bar materially to increase; for the exact balance is, at all times, kept up by the constant removal of superfluous matter, by the action of the currents of the neighbouring ocean.*

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* As an instance of the power with which rivers act, in filling up inland lakes, and in adding to the accumulations in the bed of the sea, the following example may serve to give an idea.

The river Kander, a mountain torrent of no great size, rushes down the valley of Kanderthal, in the Canton Burne, in Switzerland, and enters the lake of Thoun, about four miles from the town so called. About a hundred years ago, this stream did not flow into the lake, from which its course was cut off by a ridge of diluvial hills of several hundred feet in height, stretching along the south side of the lake, in a north-westerly direction. This diluvial ridge, extending more than ten miles in length, is entirely composed of rounded gravel, or pudding stone.

In consequence of the mischief done by the overflowing of the

If this, then, is the system now in action, on a small portion of our own shores, to what an extent must it be going on around our whole island. And if we extend our view, and consider the more gigantic scale of the rivers on the con-

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Kander, to a great extent of valuable meadow land, in its course to join the Arr, ten miles below Thoun, which was its natural course, a spirited plan was proposed and adopted, for cutting a subterraneous passage for the river, through the above mentioned ridge, at a place where it approached the lake within about a mile, and thus admitting it into its bed. This passage was cut in the beginning of the last century (about 1715.) The descent was rapid, from the lake being considerably lower than the old course of the river. At this period, the depth of the lake was in proportion to the steep hills forming its shore. The Kander had not long followed its new subterraneous course, when it greatly enlarged the artificial tunnel, and hurried great quantities of gravel into the lake. The rapidity of the torrent in a few years enlarged its course, till at length the whole superstructure gave way, and fell in; so that there is now a most romantic wild glen, where, a century ago, there was smooth pasture and wood lands. The effects of the torrent soon became apparent in the lake: an immense quantity of gravel, and every species of rock, was carried in by the current, and lodged in its bed. In 1829, when I lived in that neighbourhood, the bed formed of this debris, was of not less extent than 300 acres; the greater part was covered with thick wood; and this secondary formation is every year increasing in the same proportion; so that, as the lake is not there of great breadth, there is every prospect of a rapid and most material change taking place in its form. I have sounded the lake at the present mouth of the Kander, and, as I found no bottom with a line of about a hundred feet, we are certain that this mountain stream has, in little more than one century, produced a secondary bed of mixed materials, of fully three hundred acres; and at least one hundred feet in depth.

One circumstance, however, is worthy of remark, with respect to such secondary formations in fresh water lakes; and that is, that in consequence of the absence of tides and currents, and that constant lateral movement kept up in the bed of the sea, we never discover in them that stratified regularity so remarkable within the action of the tide. The mixture of mineral bodies carried into an inland lake, remains, therefore, exactly as deposited at the first, and this must always be in great confusion. The difference of effect, may, perhaps, be safely taken as a guide, in judging of what some geologists have called salt and fresh water formations; and if this idea be correct, we have an additional evidence against the extraordinary theories of Cuvier, who supposed the well defined strata of the Paris basin to have been occasioned by the alternate occupation of that basin by salt and fresh water. The rounded pebbles and sand, found in lakes, are never formed in the lakes themselves, as they tinents, and the more direct influence of the great currents upon their vast importations, we shall find a cause fully sufficient for the formation of secondary deposits of great depth and variety, in the course of a comparatively short space of time.

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are in the bosom of the sea, but are carried into them by the rivers nearly in the shape in which we find them.

It may, therefore, be safely assumed, that the regular strata of sand, or gravel, or of fine clay, found in mosses, and shallow lakes, if quite distinct from other strata, must have been formed at the period of the deluge, under the influence and by the agency of the action of the sea. +

Did the inhabitants of the [illegible], previous to the deluge, gather their [illegible] from the "bare granite?

CHAPTER VI.

The Deluge.—Traditional Evidence of that Event.—Erroneous Ideas commonly entertained respecting it.—Distinctness of Scripture on the Subject.—Evidence from Scripture.—Evidence from the Ancient, though Apocryphal, Book of Enoch.—Theories of Philosophy on the Subject.—The most probable Cause of that Destructive Event.

In the former part of this work, and in taking a general view of the phenomena presented to our observation on the surface of our earth, a confident hope was held out, that we should be able fully to account for all those phenomena, by considering, with a candid and unprejudiced judgment, the three great events recorded in history, viz. 1st, the creation of the world; 2d, the formation of a bed for the gathering together of the waters, together with the action of the laws of *nature* within that bed, for upwards of sixteen centuries; and lastly, the deluge, as described by Moses in the book of Genesis. We have already, at some length, considered the two first of these great events; and in the last of the two, we have found an unquestionable source of very extensive secondary formation, and sufficient to account for a large proportion of all those, actually existing, on the primitive surface of the earth. We have thus satisfactorily explained the formation of the transition rocks containing few or no fossil remains; and also accounted for the early sand stone, and calcareous formations, together with the abundance of fossil sea shells found in the latter.

We now, therefore, come to the consideration of that great event by which so complete a revolution has occurred upon the earth, and by means of which alone we are now enabled to trace out a part of the operations of those laws, to which the world has been submitted by its Creator. For had we now been placed in the situation of the antediluvian world, as inhabitants of a *primitive* surface, we could have had none of that information which we now derive from the inspection of the *secondary* formations on which we dwell.

"According to the most approved systems of chronology, this remarkable event happened in the year 1656, after the creation, or about 2348 years before the Christian æra.—Of so general a calamity, from which only a single family of all then living on the earth was preserved, we might naturally expect to find some memorials in the traditionary records of Pagan history, as well as in the sacred volume. Its magnitude and singularity could scarcely fail to make an indelible impression on the minds of the survivors, which would be communicated from them to their children, and would not be easily effaced from the traditions even of their latest posterity. A deficiency in such traces of this awful event, though it might not entirely invalidate our belief of its reality, would certainly tend considerably to weaken its claim to credibility; it being scarcely probable that the knowledge of it should be utterly lost to the rest of the world, and confined to the documents of the Jewish nation alone.

"What we might reasonably expect, has accordingly been actually and fully realized. The evidence which has been brought from almost every quarter of the world, to bear upon the reality of this event, is of the most conclusive and irresistible kind; and every investigation which has been made concerning heathen rites and traditions, has constantly added to its force, no less than to its extent."—*Edin. Ency. Deluge.*

Without entering at great length into the evidence on this subject, which has been brought from the most distant heathen lands, it may perhaps be sufficient, here, to state generally, that allusion is made, more or less directly, to the flood of Noah, and to Noah himself, under various names, by the ancient Greek, Latin, Egyptian, Oriental, and Chinese authors. Lucian, a Greek author, and an avowed scoffer at all religions, gives a history of the deluge, and of Noah under the name of *Deucalion*, so minute and circumstantial, that it must certainly have been taken from the ancient tradition of the same event which is described by Moses. The accounts of the flood of Deucalion of the ancient heathens, bear so strong a resemblance to the Mosaic narrative in some parts, that no one can doubt their being founded on traditions of the flood of Noah. Deucalion, the son of Prometheus, reigned over part of Thessaly. The impiety in the world had irritated Jupiter, who resolved to destroy mankind; and immediately the earth exhibited a boundless scene of waters. The highest mountains were climbed by the terrified inhabitants of the earth; but these seeming places of security were soon overtopped by the rising waters, and no hope was left of escape from the universal calamity. Prometheus advised his son to make himself a ship; and by this means he saved himself and his wife Pyrrha.—As to the account of the flood given by Ovid, it appears nearly certain, from the order in which he describes the creation, and from the facts connected with the deluge, as described by him, that he was acquainted with the sacred volume. The Septuagint translation had, at that period, been known for more than two centuries; and being written in a language with which all well-educated Romans were perfectly conversant, it is more than probable that the ideas of the heathen poet were directly derived from this source.—The accounts given by Plutarch, Plato, and Diodorus Siculus, show that the Egyptians believed in a universal deluge, and allude to Noah under the title of Osiris, but in the obscure and confused manner to be expected in their heathen traditions.

Sir William Jones, in his valuable researches into the works and traditions of the Hindoos, gives us the substance of their accounts of the deluge, which, though also full of the wild superstitions of the east, bear the strongest marks of the same origin. But the most extraordinary traditional evidence of this event, comes from quarters where it could be least expected, and is consequently of the greater value, as it could not have been handed down by any other means than oral tradition, from one generation to another. Some of the inhabitants of Otaheite, on being asked by one of our circumnavigators concerning their origin, replied that their supreme God, having, a long time ago, been angry, *dragged the earth through the sea*, when their island was broken off, and preserved. In the island of Cuba they relate, that an old man, knowing that the deluge was approaching, built a ship, and went into it, with a great many animals; that he sent out from the ship a *crow*, which did not immediately come back, staying *to feed on the carcasses of dead animals*, but afterwards returned with a green branch in his beak. From Peru, Brazil, and Mexico, the traditions of the duluge are very distinctly marked with traces of the original from whence they must all have come; and even among the Iroquois Indians of America, it is believed that a great lake overflowed its banks, and in a short time covered the whole earth, in consequence of the dogs of one of their spirits being lost in it, while hunting.

It has frequently been asked by those who are incredulous on many points of Scripture history, how it happened in ancient times, when navigation was little known, that the most distant islands, in the midst of the ocean, and the entire continent of America, so recently discovered by Europeans, became inhabited, if it were true that all men perished except one family, who were landed in Asia. It is difficult to reason with those who are sceptical on scriptural subjects, because such persons are too often unsettled in their belief of the *omnipotence* of a Creator. To such, therefore, it were almost useless to observe, that a being who could cause a deluge, and re-arrange a dry land, in the diversified, and as it were, *accidental* forms we now find it, could, in ways *apparently as accidental*, spread abroad the human beings which were to people it. But to such persons, perhaps, the remarkable fact of the universal tradition of the deluge, from which only a few persons were saved, is more convincing than the most conclusive abstract reasoning: and the more especially when these traditions are found to exist even amongst those very isolated nations, the descent of which, from Noah, appeared so problematical. If we add to this tradition, the strong coincidence in the *languages of all nations*, which we shall have occasion to remark upon in a subsequent chapter, the mind of that man must be of a singular character, which can retain a doubt of the truth of the inspired history on the subject of the deluge. There are, however, so many instances which may be produced, from the voyages of navigators, of savages in their canoes being drifted out to sea, and carried by winds or currents to great distances, that no reasonable objection can be raised to the spread of population, even in this accidental manner. Mr. Mariner, and Captain Dillon, in their accounts of the South Sea Islands, furnish us with many instances of such accidents.

"When we thus meet with some traditions of a deluge in almost every country, though the persons saved from it are said, in those various accounts, to have resided in districts widely separated from each other, we are constrained to admit, that so general a concurrence of belief could never have originated merely by *accident*. While the mind is in this situation, Scripture comes forward; and presenting a narrative more simple, better concocted, and bearing an infinitely greater resemblance to authentic history than any of these mythological accounts, which occur in the traditions of Paganism, it immediately flashes a conviction on the mind, *that this must be the true history* of those remarkable facts, which other nations have handed down to us only through the medium of allegory and fable. By the evidence adduced from so many quarters, the *moral certainty* of the Mosaic history of the flood appears to be established on a basis sufficiently firm to bid defiance to the cavils of scepticism. Let the ingenuity of unbelief first account satisfactorily for this universal agreement of the Pagan world, and she may then, with a greater degree of plausibility, impeach the truth of the Scripture narrative of the deluge."—*Edin. Encyclop. Deluge.*

The *moral certainty* we thus attain of the Mosaic deluge itself, may be, with equal force, extended to the preservation of Noah, and those with him in the ark, as the only living beings preserved from this, otherwise universal, destruction; and thus, from every hand, may be drawn additional evidences to confirm our confidence in the unerring truth of the inspired writings.

The Mosaic narrative of the deluge is as full and circumstantial as we could almost desire; but, like many other most interesting points in Scripture, its very simplicity occasions our not giving it that attention which it so well merits; and there is, perhaps, no subject on which the general ideas of mankind are so erroneous.

The most common notion entertained of this catastrophe, is, that by some means, incomprehensible to us, the sea rose upon the dry land to the height of the highest mountains; and after destroying every living thing, excepting those whom it pleased God to spare, the waters gradually retired to their hidden retreats, leaving *the same dry land* that had before been inhabited, though variously changed, in its actual surface, by the wreck and ruin with which it remained charged.

It would be difficult to say from what source this erroneous idea of the deluge has first arisen; the *mode* by which this fatal event was brought about by the councils of the Almighty, has not indeed been given us by the inspired historian; ‡ but the clearness of the recital, together with the effects, which we now every where find to corroborate it, can leave

‡ "I will cause it to rain upon the earth 40 days & 40 nights." Gen. 7. 4. "And the windows of heaven were opened." Gen. 7. 11.

no doubt in an unprejudiced mind, that the above mentioned common opinion is altogether false, and has given rise to many of the equally false doctrines and theories of the chaotic geology.

In the Mosaic record we are told, "And God said unto Noah, the end of all flesh is come before me; for *the earth* is filled with violence through them (mankind), and behold, I will destroy them, TOGETHER WITH THE EARTH."*

Here we have it distinctly announced by the voice of the Almighty, that he was not only to destroy mankind *from off the earth*, which would have implied the earth remaining as at first, to become the habitation of a postdiluvian race: but they were to be destroyed TOGETHER WITH THE EARTH on which they dwelt. It is also afterwards declared by the Almighty, in establishing a covenant with mankind: "And I will establish my covenant with you, neither shall all flesh be cut off any more by the waters of a flood; NEITHER *shall there any more be a flood to* DESTROY THE EARTH."† The latter part of this sentence would have been altogether unnecessary, were we not given to understand by it, that the earth, or dry land, of the antediluvian world, had then been destroyed, as well as its wicked inhabitants.

A very close critical inquiry has been instituted by Mr. Granville Penn, into the various translations of the original text on this part of Scripture; and he proves, beyond dispute, that the original, in these passages, has never had any other interpretation, or translation, than that adopted in our English version; implying the destruction *of the earth*, as well as "of all flesh that moved upon it." This estimable writer has not confined his scriptural inquiries to the Mosaic history alone; but has most ably drawn from other inspired sources, what were the received opinions respecting the deluge, throughout the whole period of Jewish history, down to the times of the apostles. He brings forward that very remarkable passage, from the 2d Epistle of St. Peter, 3d chapter, 6 and 7 verses, "*whereby the world, that* THEN WAS, *being overflowed with water*, PERISHED; but the heaven, and the EARTH, WHICH ARE NOW, by the same word (of God) are kept in store, reserved for fire, against the day of judgment, and perdition of ungodly men."‡ Mr. Penn also quotes a passage from the Book of

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* Genesis, vi. 13. † Ibid. ix. 11.

‡ This passage, from the inspired apostle, might, perhaps, be

Job, in which the friend of Job, reasoning with him, says, "Hast though remarked the old way which wicked men have trodden; who were cut down out of time; *whose foundation was overflowed with a flood;*" which passage the Greek interpreters render yet more decidedly, "*their foundations are become an overflowing flood,*" and Michaelis interprets it, "*A flood* OBLITERATED *their foundations.*"

In the very curious and interesting work, called the book of Enoch, referred to by St. Jude, v. 14, which had long been looked upon as lost, but which was at length discovered in the Ethiopic language by Bruce, in Abyssinia, who brought home three manuscript copies of it, one of which was presented to the Royal Library at Paris, a second, to the Bodleian Library at Oxford, and the third, retained by himself; we find a very remarkable corroborative testimony to the above view of the subject of the deluge. In quoting, from this apocryphal book, it is not necessary, in this place, to enter into the question of its actually being, what its title professes it to be, a prophetic work of the antediluvian Enoch. This point has been clearly settled by Dr. Laurence, to whom we are indebted for an English translation of the copy in the

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extended with much effect; for he seems, in this part of his general epistle to the new Christian church, prophetically to describe some of the opinions now held by modern philosophy.

"This second Epistle, beloved, I now write unto you; in both which (Epistles) I stir up your pure minds by way of remembrance:

"That ye may be mindful of the words which were spoken before by the holy prophets, and of the commandment of us, the apostles of the Lord and Saviour: knowing this first, that there shall come, in the last days, scoffers, walking after their own lusts:

"And saying, where is the promise of his coming? For since the fathers fell asleep, all things continue as they were from the beginning of the creation. For this they willingly are ignorant of, that, by the word of God, the heavens were of old, and the earth standing out of the waters, and in the waters:

"Whereby" (viz. by the word of God,) "the *world* that *then* was, being overflowed with waters, *perished.*

"But the heavens, and the earth, which *now are*, by the same word (of God) are kept in store, reserved unto fire, against the day of judgment, and perdition of ungodly men.

"But, beloved, be not ignorant of this one thing, that one day is, with the Lord, as a thousand years, and a thousand years as one day."—Second Epistle of Peter, iii. 1, &c.

This short passage contains lessons in philosophy, as well as in morality, which we should do well most seriously to consider.

Bodleian Library. But, although, in the opinion of the learned translator, this original Hebrew, or Chaldee work, was composed subsequent to the Babylonish captivity, it must be admitted to be a very interesting and curious piece of antiquity, though not worthy of a place among the canonical books of Scripture.

The passage I am about to quote, however, will serve to show the prevailing opinion on the subject of the deluge in the times of the author of it, and is quite consistent with the passage in St. Peter's Epistle, and with the above passage in the book of Job.

In the 82d chapter of the book of Enoch, and the 5th verse, we find the writer prophetically describing the destruction of the "earth, that then was," in the following manner:

"And falling to the earth, I saw likewise *the earth* ABSORBED BY A GREAT ABYSS, and mountains suspended over mountains, *hills were sinking upon hills*, lofty trees were gliding off from their trunks, and were in the act of being projected, *and of* SINKING INTO THE ABYSS.

"Being alarmed at these things, my voice faltered. I cried and said, THE EARTH IS DESTROYED! Then, my grandfather, Malalel, raised me up, and said to me, Why dost thou thus cry out, my son? And wherefore dost thou thus lament?

"I related to him the whole vision which I had seen. He said to me, *confirmed is that which thou has seen*, my son:

"And potent the vision of thy dream respecting every secret sin of the earth. ITS SUBSTANCE SHALL SINK INTO THE ABYSS, *and a great destruction take place*.

"Now, my son, rise up; and beseech the Lord of Glory, (for thou are faithful,) that a remnant may be left upon the earth, and that he would not *wholly* destroy it. My son, all this calamity upon earth comes down from heaven, *upon earth shall there be a great destruction*."

In another part of the book, purporting to be *Noah's vision of the deluge*, we find the following, to the same effect: "On account of their impiety have their innumerable judgments been consummated before me. Respecting the moons have they inquired, and they have known *that the* EARTH WILL PERISH, *with those who dwell upon it*, and that to these there will be no place of refuge for ever."—Chap. lxiv. v. 9.

These passages, from such authorities, decidedly show, that the destruction of "*the earth that* THEN WAS," formed a part of the effects of that awful judgment; and the phenomena presented to our view over the whole "*earth that* NOW IS," establish the truth of the historical record in a manner the most conclusive. We have thus given us most important data on which to form a judgment of the *mode* by which this great event was brought about; but, as the mere *laws of nature* will be found utterly incompetent to it; and as the deluge was evidently an operation as completely *preternatural*, as either the creation itself, or the gathering together of the waters of the ocean, we must come to the same conclusion with regard to it which we have already done with regard to these events, viz. that it was in the power of God alone to bring it about.

Many disputes have arisen, and theories been formed, among philosophers, respecting the *mode* by which a deluge might have been brought about *by natural causes;* but, like the theories of *first formations*, they lead the mind, at every step, into obscurity and contradiction. Some have supposed the earth *to be hollow*, and to contain water, which, issuing out by some incomprehensible means, deluged the earth, and again retired to its hidden abode. Others have supposed that by a great earthquake, a heaving up of the superincumbent mass of one portion of the earth might have raised the waters of the ocean, so as to form *one vast wave* on the surface, which swept over the remaining parts of the earth. In supporting this theory it is truly stated, that during partial earthquakes, an agitation of the sea, somewhat similar, takes place, the effects of which have often been most destructive in low countries. But this theory implies one sweeping convulsion which could have lasted but a short time, and been but partial in its effects; whereas, both history, supported by the traditions of the most obscure nations, and physical facts, tend to convince us that the deluge must have lasted some considerable time, and been *universal* in its destructive effects.

As to the theory of the *cavous* nature of the globe, in order to contain water for the purpose of one particular deluge of a few months duration, we have, amongst other powerful objections, this especial one; that such an arrangement would be in contradiction to all the general laws of the Creator, in the study of which we perceive an *economy of means*, if I may use the expression, which is most remarkable. The *means* employed for any *end* are never greater than are absolutely necessary to attain that end; and thence the just balance which we so much admire throughout the creation. When the mandate was issued, on the third day of the creation, "Let the waters be gathered together unto one place, and let the dry land appear," which "gathering together of the waters God called *sea*," we have not a vestige of ground for supposing that there was any *supcrabundance in the primitive creation of water;* nor that any portion of it was, as it were, locked up from common use, and reserved for one especial occasion. Besides this objection of the *reason*, we have also one *fact;* for when we come to measure the depths of the sea, and the quantity of water existing on our whole planet, by the great and only true scale before mentioned;* and when we find its medium depths, all over the earth, not to exceed, comparatively, a thin coat of varnish on a common artificial globe; we shall at once perceive how utterly unnecessary it would be to demand so great a quantity of water as a *hollow earth* would contain, for the sole purpose of effecting so diminutive an end.† No. The ends of the Almighty are brought about by much more simple means; and when we are informed by the inspired record, that not only the inhabitants of the first "dry land," but also that "dry land" *itself* was to be destroyed, we can, without any strain upon our reason, and in perfect accordance with surrounding physical facts, imagine the same great Being by whose power the waters were at first gathered together, issuing his second mandate for the execution of this terrible decree, and saying, "Let the level of the dry land be lowered, and let the foundations of the great deep be broken up: and it was so." ‡

But if we insist on *discovering* or *inventing* a *mode* by which the Almighty caused this destructive interchange of sea and land to take place, we shall find ourselves in the same inextricable difficulties as when endeavouring to account for the *mode* of first formations *by secondary causes.* We must make our reason bend to the inscrutable ways of the Omnipotent, and submit, with whatever rebellious reluctance, to the great truth every where impressed upon us, that "the ways of God are not as our ways, nor his thoughts as our thoughts." All our reasoning must end in this point, that the deluge, like the creation, was a *preternatural event*, which could by no means be brought about but by *preternatural means;* and consequently, that we should in vain search for a cause in *the mere laws of nature.*

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* Chapter i, page 37, note.

† Would not a hollow glass globe, of one foot in diameter, contain infinitely more water than would be necessary slightly to moisten its exterior surface?

‡ How does that consist with the following passages:— "And God made a wind to pass over the earth, & the waters asswaged." Gen. 8, 1. "— until the waters were dried up from off the earth." 8. 7.

CHAPTER VII.

Mosaic Account of the Deluge.—The Mountains of Ararat.—Origin of that remarkable Name.—Effects during the Deluge.—Action of the Tides and the Currents during the Deluge.—Their Effects upon Organic Bodies.—Diluvial Strata.—Abatement of the Waters.—Renewal of the Face of the Earth.

Having thus, by a variety of evidence, convinced ourselves that a universal deluge took place upon our earth, from which but one family of human beings was saved by the mercy of the Almighty;* and that, in this deluge, not only the antediluvian race, but the antediluvian *earth* or dry land on which they dwelt, was destroyed, we can be at no great distance from the truth, if we suppose, though it is no where stated in direct terms, that the deluge was effected by the interchange of level between the former sea and land; or, in other words, that either the bed of the former sea was gradually *elevated*, or "*broken up;*" or that the first land was gradually *depressed* beneath the level of the waters; or, perhaps, by a combination of *both;* in either of which cases, the effects would be exactly such as are described in the Mosaic record; #

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* The preservation of one family, at the deluge, may be looked upon as one of the most remarkable instances of divine wisdom and providence: for there could have been no greater difficulty to the Almighty power, in forming, in this instance, an entirely new creation, than in doing so in the beginning of the world. But if all mankind had perished, a new race could not have been so deeply impressed with the terror of this great event, as we now find the most distant nations are: and if we had only historical evidence of its having happened, unsupported by tradition and facts, the recital would be found to make but a slight impression upon our minds.

which record simply tells us, "all the high hills were covered" Gen. 7.19. "And the ark rested upon the mountains (which had been, or then were,?) of Ararat." &c.

Let us now consider this record itself.

"And God looked upon the earth, and behold it was corrupt; for all flesh had corrupted his way upon the earth. And God said unto Noah, The end of all flesh is come before me; for the *earth* is filled with violence through them (men); and behold I will destroy them, WITH *the earth*." "Behold I, even I, do bring a flood of waters upon the earth, to destroy all flesh, wherein is the breath of life, from under heaven; and every thing that is in the earth shall die." "And, in the six hundredth year of Noah's life, in the second month, the seventeenth day of the month, the same day were all the fountains of the great deep broken up, and the windows of heaven were opened." "And it came to pass, after seven days, that the waters of the flood were upon the earth." "And the same day were all the fountains of the great deep broken up, and the windows of heaven were opened." "And the rain was upon the earth forty days and forty nights." "And the waters prevailed, and were increased greatly upon the earth, and the ark went upon the face of the waters." "And all the high hills, that were under the whole heaven, were covered." "Fifteen cubits upwards (above the highest hills) did the waters prevail, and the mountains were covered." "And the waters prevailed upon the earth an hundred and fifty days." At length, "God made a wind to pass over the earth; and the waters assuaged. The fountains also of the deep, and the windows of heaven were stopped, and the rain from heaven was restrained. And the waters returned from off the earth continually; and after the end of the hundred and fifty days the waters were abated. And the ark rested in the seventh month, on the seventeenth day of the month, upon the mountains of Ararat. And the waters decreased continually until the tenth month: in the tenth month, on the first day of the month, were the tops of the mountains seen. And it came to pass at the end of forty days, that Noah opened the window of the ark, which he had made. And he sent forth a raven, which went forth, to and fro, until the waters were dried up from off the earth. Also he sent forth a dove from him, to see if the waters were abated from off the face of the ground. But the dove found no rest for the sole of her foot, and she returned unto him into the ark; for the waters were on the face of the whole earth: then he put forth his hand, and took her, and pulled her in unto him, into the ark. And he stayed yet other seven days, and again he sent forth the dove out of the ark; and the dove came in to him in the evening; and, lo, in her mouth was an olive leaf plucked off: so Noah knew that the waters were abated from off the earth; and he staid yet other seven days, and sent forth the dove, which returned not again unto him any more." "And Noah removed the covering of the ark, and looked, and behold the face of the ground was dry. And in the second month, on the seven and twentieth day of the month, was the earth dried."*

Thus the whole duration of this dreadful event was one year and ten days; or from the seventeenth day of the second month of one year, until the twenty-seventh day of the second month of the next year.

Now, in the whole of this narrative, we find no one circumstance to lead us to a supposition, that the *same earth*, or dry land, existed *after* the flood, as had been inhabited *previous* to that event; or to contradict the united evidence of the declaration of the intention of God to *destroy the earth*, and of the physical facts with which we are now surrounded, on every part of the present dry land. An erroneous idea is, however, very general with respect to "*the mountains of Ararat*," which are commonly considered as having been mountains on the old earth, and known to Noah. There can be no one reason given *from the narrative* for this opinion, and there are many of the most decided character to lead us to an opposite conclusion.† The inspired historian is describing to the Jewish nation, many years after the event, and when the continent of Asia had become perfectly well known, and thickly peopled, the circumstances of the destruction of the former world by means of the flood; and he relates, that on the subsiding of the waters, the ark, with its inhabitants, grounded on one of the points of a ridge of mountains, which was, from henceforth, to be remarkable amongst the inhabitants of the East, and to which those saved from the deluge gave the expressive name of *Ararat*, or the CURSE OF TREMBLING (which is the meaning of the Hebrew word), that the memory of the dreadful event from which they had just escaped might be handed down as long as the mountain was in being, on which they had been saved. We may also come to the same conclusion when we consider the *improbability* of the ark floating quietly for nearly a year on the surface of an ocean as much effected by *winds* and *tides* as our present seas, being stranded in the immediate neighbourhood of the place whence it is generally, but erroneously, supposed to have been first borne up by the waters: and, also, the equally improbable circumstance of any mountain of the old world bearing such a title as *the curse of trembling*, *previous* to any event likely to call forth so remarkable a name. We must not forget, besides, that even those who support the idea of our now inhabiting the antediluvian earth, admit that the effects of the deluge were such as would probably prevent the recognition by those in the ark, of any part of the former countries they had known, as the surface must have been every where loaded with diluvial soils of very great depth.

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* "According to the account given by Moses, the ark was 300 cubits long, 50 broad and 30 high; but the length of this cubit has given rise to much argument and conjecture. Some have supposed it to be nine feet, and others three; but the opinions most worthy of notice are, 1st, That of Bishop Cumberland, who considered the Hebrew cubit as about 22 inches, which would make the ark 550 feet long, 91 broad and 55 high. 2d, That of the learned Parkhurst, who computes the cubit at something less that 18 inches, which makes the ark 450 feet long, 75 broad and 45 high. Even upon the smallest estimate of this cubic measure, the competency of the ark, for the purpose assigned to it, has been satisfactorily proved by different writers; but, especially, by the ingenious Bishop Wilkins, who has established the point with a clearness and exactness almost amounting to demonstration, and rather found too much than too little room. Thus does this seeming difficulty, like many others connected with scripture history, the more closely it is investigated, furnish an evidence, instead of an objection, to the truth of revealed religion."—*Edin. Encyclop. Ark.*

† Jerom places Mount Ararat towards the middle of Armenia, near

the river Araxes, or Aras, about 280 miles north-east of Al Judi, and 12 leagues south-east of Erivan. It is detached from the other mountains in its neighbourhood, and stands in the midst of a very extensive plain. It is in the form of a sugar-loaf, and has two distinct summits, the largest of which is perpetually covered with snow, and may be seen at a great distance. It is not a little singular, that the description of Mount Parnassus, by Ovid, should bear so close a resemblance to this account of Ararat:

> "Mons ibi verticibus petit arduus astra duobus
> Nomine Parnassus, superatque cacumine nubes."

The surface of the lower part is composed of loose sand, or large masses of free stone. Nothing is to be seen growing upon it but some juniper and goat's thorn. The whole mountain is described by travellers as having a gloomy and disagreeable aspect.—*Tournefort*, *Tavernier*, *&c.*

All these reasons, taken collectively, and supporting the positive sentence of destruction passed upon "the earth that then was;" leave no room to doubt as to the mode by which this sentence was put in execution. We may, therefore, conclude, that when the time was come, when this great revolution was to happen, the dry land began gradually and insensibly to sink, or the surface of the bed of the former ocean as gradually to rise; the whole accompanied with such a convulsion of the elements, such torrents of rain, and, probably, such peals of thunder, as would be calculated not only to make a lasting impression upon the minds of those who escaped; but to render the punishment of those who suffered from this *Curse of Trembling* the most awful and heart-rending that the mind of man can conceive!* The living creatures upon the earth, of every kind, must then have been gradually swept from the elevations on which they would naturally seek safety: and at the end of forty days the whole globe became again overspread with the same thin coat of water, from the effects of which it was "*invisible*" on the first and second days of the creation.

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* We may apply to this subject the sublime expressions of the Inspired Psalmist, when alluding to the miraculous preservation of the children of Israel, pursued by the Egyptians; and it is even probable, that he had also in view the very event we are now contemplating.

"The waters saw thee, O God, the waters saw thee; they were afraid: the depths also were troubled. The clouds poured out water: the skies sent out a sound: thine arrows also went abroad. The voice of thy thunder was in heaven: the lightenings lightened the world; the earth trembled and shook. Thy way is in the sea, and thy path in the great waters, and thy footsteps are not known."—Psalm lxxvii.

In the 104th Psalm, we find what may be considered a more direct allusion to the creation, and to the period of the deluge, in the following sublime passage.

"Who laid the foundations of the earth, that it should not be removed for ever.

"Thou coveredst it with the deep, as with a garment: the waters stood above the mountains.

"At Thy rebuke they fled; at the voice of Thy thunders they hasted away.

"They go up by the mountains; they go down by the valleys unto the place which Thou hast founded for them.

"Thou hast set a bound that they may not pass over; *that they turn not* AGAIN *to cover the earth.*"

> "Jamque mare et tellus nullum discrimen habebat;
> Omnia pontus erant; deerant quoque littora ponto."

For 150 days, or for about five months, this universal aqueous covering remained nearly stationary; and it is from this long continuance of the waters upon the earth, that we can account, in a satisfactory manner, for many of the stratified appearances in the *upper beds*, which we had before remarked in the *lower* secondary formations. We feel quite assured, that though, by this great revolution, the face of all things upon the earth's surface was to become changed, yet the planet still retained its regular position and place in the solar system, and must, consequently, have continued to be affected, as it was at other times, by the influences of the sun and of the moon. The action of the tides and of the currents, which we have before considered, must now have had a most powerful influence both during the *rise*, the *continuance*, and the *abatement* of the waters. The surface of the all-prevailing ocean must now have been covered with the wreck and ruin of the animal and vegetable world, floated off in various directions, according to the currents, and the eddies, which must have every where prevailed. The soils of the old earth, loosened by the moisture, must now have become suspended in the turbid waters, and been deposited in the bed of the ocean as at other times, only in unusual quantity.* Dead bodies of every description, *swelled up by corruption*, must now have followed the courses of the currents, and floated or sunk, according to the state they happened to be in. Those of the larger animals more especially, would long continue *floating* on the waves, like strong bladders filled with mephetic vapours, and be hurried far from their natural climates, to excite the wonder and speculation of succeeding generations.

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* In a former note, referring to the lately published work of Mr. Lyell, (see page 71), we had occasion to observe the wonderful effects of rivers, in transporting materials for the formation of secondary strata in the bed of the sea. The account given in that note, of the mud of the Ganges, in its daily course, will serve to give us some faint idea of the turbid state of the whole ocean, at this eventful period: and the sediments deposited by this catastrophe, added to the secondary formations in the antediluvian sea, formed in the space of 1650 years, will produce a much more consistent result than can possibly be extracted from the theories of geology, which give an unlimited time to the age of the world.

At length the waters are permitted to subside; the full purpose of the Almighty has been accomplished. The earth and its inhabitants have been destroyed; and the waters are again to be "gathered unto one place," to "let the dry land" once more "appear." What a scene now presents itself to the mind's eye! for no human eye could look upon it; even Noah himself could form no distinct idea of the state of the new earth, but by sending out one of his feathered family, who he knew would return to him, if "she found no rest for the sole of her foot." Week after week passed with those occasional experiments, long after the ark had been finally lodged upon the heights of Ararat. It is now left to our imagination to conceive *effects* which, though not described, must have naturally followed such powerful *causes*. As the waters gradually subsided into their new bed, the dry land, which was now to come for the first time into the light of day, must have presented a most singular appearance. We must keep in mind, that as the bed of the first ocean had become charged with the stratified debris of upwards of sixteen centuries, deposited upon it by the laws of gravitation and of the currents, the surface of this bed, when raised above the new level of the waters, must have been soft, and still saturated with the moisture of the slowly retiring seas. As the waters became more and more shallow, they would act with the more violent effect upon the soft and muddy plains over which the *tides*, the *currents*, and the *winds*, must now have swept with irresistible force. As point after point upon the new and soft earth became liberated from their sway, the various floating bodies, whether animal or vegetable, would be scattered on the surface, or deeply embedded in the yielding mud or sand by the violence of the waves. Other mixed masses of organic remains, brought into one place in an indiscriminate heap, by the eddies of the waters, would now be covered up by these new secondary formations, of mud, or gravel, which formations would be of very considerable depth, from the enormous quantities of materials thus furnished in a preternatural way. It is also highly probable that many submarine volcanic districts would now become exposed, and also that even volcanic action was not wanting to complete the terrors of this *curse of trembling*. In whatever manner the Almighty thought fit to bring about this elevation of the bed of the antediluvian sea, it is to be supposed that the "breaking up" of the fountains, or foundations, of the great deep must have occasioned that elevation and derangement in the horizontal stratifications of some of the secondary formations which we have hitherto speculated upon in darkness, and in error: and that we should consequently find them, when fully exposed to our view, in a *highly inclined*, and sometimes even in a *vertical* position.*

Let us imagine to ourselves the whole vegetable kingdom of the earth deposited at various depths,† and more or less covered up by the sandy or other sediments of the deluge. We look in vain to the most terrific catastrophes of our own times, to give us a faint idea of the scene which the earth must now have presented. Those who have witnessed the raging of a hurricane on the ocean, many leagues distant from any land, can perhaps best form a conception of this watery waste, unsheltered by any shore.

The tossing of a tall ship, at the mercy of a raging sea, may best represent the manner in which the floating masses must have been precipitated on the yielding shoals. For "they that go down to the sea in ships, and do business in the great waters; these see the works of the Lord, and his wonders in the deep."

At length it was permitted to the elements, by the Great Ruler of the storm, to resume their wonted order and regularity.

"Surgit humus, crescunt loca decrescentibus undis."

The new bed of the ocean, when sunk to the necessary depth, was there arrested; and means were thus afforded to the new dry land, of becoming gradually drained of its superabundant moisture. The order of the world was to be reinstated, and the command was given to Noah to quit the ark, and to lead out with him his family, and every living creature that had been with him in the ark, that they might "breed abundantly in the earth, and be fruitful and multiply upon the earth." "And God said, I will not *again* smite every living thing, as I have done; *but while the earth remaineth*, seed time and harvest, and cold and heat, and summer and winter, and day and night, shall not cease."

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* All such derangements of the stratifications of the surface of the earth, must not, however, be attributed to this cause, for there can be no doubt, that in the upper strata occasioned by the deluge, and left by the waters in a very moist state, the derangements of their level must be accounted for in the very natural way of subsidence in the course of dessication.

† We are enabled to form some idea of the floating or sinking masses of matted vegetable productions, from the accounts given us of the floating islands of timber, in some of the American lakes: these are often several miles in length, and of very considerable breadth and depth, rising or falling with the water, and covered with vegetation. In the deluge, when the soils of the forests became saturated with moisture, the whole vegetable mass would naturally rise to the surface, bound together by the roots and branches, and be floated off by whatever current happened to prevail in their immediate neighbourhood.

It seems scarcely necessary here to raise a question as to how the new world became again replenished with verdure, and adorned with a renewal of all those riches which the deluge must have so completely destroyed; because all who are deeply impressed with the effects produced by the fiat of the Almighty, at the first creation, must be satisfied that, though no direct mention is made of a new creation of vegetable substances after the deluge, it must have been both as *necessary*, and as *easy* an operation, as in the beginning. The vegetable world must have been *completely obliterated* at the deluge, even supposing that the old earth had merely suffered from a *passing* event: but when we find that the new earth which we now inhabit, appeared then, for the first time, in the light of the sun, and that it must have been composed of moist soils, on which no vegetable production had ever grown, we shall be forced to the conclusion which is most consistent with reason, in the absence of historical evidence; and that is, that the creative power must have been again exercised upon this occasion. Nor shall we, indeed, find it necessary to stop at a new *vegetable* world; for there are many reasons for extending this conclusion also to the animal world, though, probably, on a less extended scale, as we have the positive evidence both of tradition and of history, as to a great variety of animals having been saved in the ark, together with Noah and his family. It appears more than probable, however, that we ought to consider the strong expression used in the record, "*of every living thing of all flesh*," in the same sense as we find it in various other parts of Scripture; and, indeed, as such expressions are often used in our own, and in other languages, that is, not as literally meaning every *created being* over the whole globe, but merely *a great number*.

Michaelis* remarks, "the Jews have well observed that the expression *all*, *every*, is not to be understood, on all occasions, with the mathematical sense of *all;* because it is also used to signify *many*. Thus, in Isaiah xxiv. 10, where we read 'every house is shut up,' Kimchi most truly observes, though he says *every* house, he only means *many;* as it is said, *all* countries came into Egypt. And if we reflect upon our own native tongues, we shall find that we often use the term *all* for *many*, or *most*. We have also a remarkable example of this strong mode of speech in 1 Kings, xviii. 10, where Obadiah affirms thus forcibly and solemnly to Elijah: 'As the Lord thy God liveth, there is *no nation or kingdom*, whither my lord hath not sent to seek thee:' which affirmation, though universal in its *terms*, was evidently not designed to be universal in its *signification;* and innumerable instances of the same mode of speech occur in the Sacred Writings."†

We have some reason to doubt, from the fossil remains of animals now discovered, which have not yet been found alive upon the present earth, whether *every living creature* was included in this strong expression: and though, from the remarkable circumstance of the similarity of all languages in certain commom expressions, and in the universal tradition of the deluge found amongst the most distant and savage nations, we feel assured that the whole existing race of *man* on the whole earth, has sprung from Noah and his family; we have no evidence to lead us to the same conclusion with respect to quadrupeds, or birds found in such isolated countries as New Holland, where the species so entirely differ from every kind known on other parts of the earth. With respect, also, to the lower classes of animated beings, including reptiles, insects, and animalcula, to which latter there seems no bound in the creation, we feel inclined to believe that a new creative power was exercised after the deluge; and we may, in this instance, say with the inspired Psalmist, "He took away their breath, and they died, and returned to their dust: He sent forth His Spirit, and they were *created*, and He *renewed the face of the earth*."

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* Michaelis was a celebrated German theologian and biblical critic, who died in 1791. The extensive knowledge which he had acquired in biblical philology, as well as in every department of learning connected with the study of the Scriptures, enabled him to form very accurate notions on the original institutions and language of the Hebrews. He was professor of Hebrew, Arabic, and Syriac, in the University of Gottingen.

† Comp. Estim. ii. p. 214.

It may, perhaps, here be asked, What reason can be assigned for the slow and gradual course of this awful judgment; since, if the first formation of the bed of the sea were an *instantaneous* operation, the destruction of the earth by a deluge *could*, and probably *would*, be equally rapid. But various good and sufficient reasons may be given, for a *gradual*, rather than an *instantaneous*, operation, in the case of the deluge. And, first, we must consider, that, by this method, the *great moral impression* which was intended to be made upon the family of Noah, and upon all succeeding generations, would be much more effectual, by the long continuance of their terror, than if they had been stunned, and, as it were, thunderstruck, by a dreadful, but rapid calamity. Again, we must remember, that as the All-Wise Ruler of the Universe had ulterior views for the welfare of his human creatures, a gradual operation acting upon what was to be the new earth, would render it better fitted for a habitation for mankind, than if the bed of the sea, with its soft sediments, had, by one violent convulsive throe, been elevated above the surface, and thus left dry, in the most deranged and ruinous condition. Besides, any such sudden convulsion must have caused so violent an agitation, that the *natural means* of preservation prescribed to Noah, by the Almighty himself, must have been overpowered by the *preternatural* vortex into which the vessel would have been plunged.

Thus, although we can in no way account for the deluge, but by supernatural agency, yet the command given to Noah to make use of so common a means of safety as a *floating vessel*, shows us that it was the intention of God to allow natural means, *or the laws of nature*, to take their course, after the first impulse had been given by his preternatural decree.*

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* The experience of every year ought to teach us caution in coming to any determined conclusion with respect to extinct races of animals. A great portion of the earth still remains unexplored, and every year makes us acquainted with some new thing in the animal world, with the existence of which we were before unacquainted.

CHAPTER VIII.

General View of the existing Surface.—Force of the Waves.—Principles of Stratification.—Cavous Limestone.—Gibraltar.—The Plains of the Earth.—Of South America.—Of Africa.—Of Asia.—Of Europe.—Result of this View.—Chalk Basins.—That of Paris, a Guide to all similar Basins.—Salt Deposits.—Coal Formations.—Evidences of Coal being a Marine, and not a Lacustrine Formation.

Thus have we followed, in as concise a manner as the subject will admit of, the traditions as well as the history of this awful event, both supported by the corroborative evidence of numerous physical facts in all parts of the world: and we cannot doubt its having been the intention of the Almighty, that the memory of so signal a judgment should be for ever deeply imprinted on the human mind, even in the most distant and isolated corners of the earth. But we should not be doing justice to so interesting a subject, if we left it, without taking a general view of the present surface of the habitable globe, and further tracing, as we shall every where be able to do, the lasting monuments of it, so universally presented to our consideration.

When we consider, then, the state of the earth, as it now is, we find it divided into sea and land; but so unequally, that the ocean occupies about three-fifths of the whole surface; and if a meridian line be taken to divide the earth equally, we shall find the proportions of land and water, on the opposite sides, strikingly different: there being a great preponderance of water on the *southern*, and of land in the *northern* hemisphere.*

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* We shall have a future opportunity of remarking the difference of temperature between the Southern and Northern Polar regions,

On viewing, on the great scale, the general condition of this land, we find by far the greater portion of it but little elevated above the level of the ocean: so little, indeed, that it may be safely said that nine-tenths of the whole would be again submerged, either by a rise in the level of the waters of a *very few hundred feet*, or by a depression of the land to a similar trifling extent. There is, perhaps, no portion of the whole extent of the *plains* of the earth, where the *primitive surface* of the globe can be seen. Nor can it even be reached by *mining*, without a deep section of various secondary formations. Even the most elevated plains, and many mountains of very considerable height, are either entirely formed of, or heavily loaded with, strata of secondary rocks. It is, generally, only on the tops of the most elevated mountain ridges, where the primitive formations of the earth are found in mass. But the lower portions of even the highest mountains, bear unequivocal marks of their having once formed the bed of the sea: and fossil sea shells have been found upon the Andes, at an elevation of 14,000 feet above the present level of the ocean. Whole ridges, however, of very considerable height, are found to be entirely formed of these secondary formations; and so full of fossil shells, that no doubt can be entertained of their present site having once formed the bottom of the sea.

The ridge of the Jura mountains, to the south-west of the Alpine range of Switzerland, is one of the most remarkable and best known of these secondary formations. This ridge rises from 3 to 4000 feet above the level of the Swiss plain; and its length is nearly one hundred leagues, being from eighteen to twenty in breadth.

It is almost entirely composed of compact limestone, in strata which alternate with beds of clay and shelly marl; and the stratification is so much inclined, that it presents a most interesting example and proof of a raising or depressing power having been in force, *subsequent to* the nearly *horizontal* stratification which must at all times take place from a deposition in water. There is, also, to be found on this secondary ridge a remarkable proof of a great mechanical power having been exerted, such as the deluge was perhaps

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which difference may, probably, be accounted for by the great preponderance of land in the one, and of water in the other hemisphere.

alone capable of. Innumerable masses of primitive rock are found scattered on the surface, even at a height of 2500 feet. These masses, so far detached from their parent rock on the Alpine summits, (and similar masses of granite are found on almost all the alluvial plains of Switzerland), have given rise to much difficulty, and various theories among geologists, all which are rendered nugatory, by referring their present locality to the powers of the deluge, the extent of which no one can reasonably doubt, who has considered the instances of mechanical force constantly exhibited by the ocean when in a state of agitation.

Some recent and remarkable instances of the great mechanical force of the waves may be interesting, on a subject which has occasioned so much theoretical discussion amongst philosophers. In the Isle of Eshaness, in Shetland, which is exposed to the full fury of the western ocean, huge blocks of stone are removed far from their native beds, and hurried up an acclivity to an almost incredible distance. In 1802, a mass eight feet by seven, and five feet thick, was dislodged from its bed, and removed to a distance of about 90 feet. The bed from which another block had been removed, in 1818, was seventeen and a half feet by seven, and two and a half feet thick. This mass had been borne to some distance, and then shivered into many lesser, though still large, fragments, which were carried more than 120 feet further. A block nine feet by six and a half, and four feet thick, was carried up a slope a distance of 150 feet. A mass of rock, the average dimensions of which may be rated *at twelve or thirteen feet square, and five feet thick*, was first moved from its bed, to a distance of upwards of thirty feet, and has since been twice turned over. But the most extraordinary scene is in a breach of porphyry called the *grind of the Navir*, where the waves have forced a passage, separating huge stones from the rock, and forcing them to a distance of nearly 200 feet. These fragments are accumulated in immense heaps, like the produce of a quarry.

In *Lunna*, several large detached rocks, called the *stones of Stephouse*, are found at some distance from the sea, having evidently been transported by the waters, and are *the transported stones* of geologists. The largest is about 23 *feet high, and* 96 *in circumference.*

Amongst the remarkable features of the mountain ridges of the earth, are the naked primitive summits of the highest peaks, which from their freedom from secondary formations, and other marks of the sea, we may, with much probability, suppose to have been in the form of *islands* in the antediluvian ocean: and as all islands are but the summits of submarine elevations, it is natural to expect to find the lower parts of these mountains, which must have long been covered with the sea, bearing the same marks of secondary and sedimentary formations, mixed with sea shells, that are found in the lower levels of the earth.

As we descend from the higher grounds towards the plains, we are every where struck with the hills of various heights and forms, entirely composed of these secondary rocks, and often formed of nothing but rounded gravel, or dry sand, precisely in the state we now find these substances on our present sea-shores, and under the continued action of the waters.*

One cannot but be sensibly struck with the close similarity, of these elevations, both in *substance* and in *form*, to those minor elevations, and valleys, formed by the present sea, in many parts of its shores. One can even trace, on a minute scale, in those recent beds of sand and gravel, the principles of *stratification and arrangement* which we remark in many of the great secondary formations, and in the great beds of upper alluvial rocks and soils: and as we have already had occasion to remark, those principles are founded on the laws of *gravitation*, and of *fluids*, by the combined action of which, the *raw materials* of secondary formations, when once indiscriminately brought into the ocean by the rivers, in the manner before described, are sifted and arranged; and the various classes *separately* deposited, according to the action of the currents, and the eddies of the waters.† It is by the action of those laws alone, that we can account for the great beds of

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* The hills of Palestine are almost all formed of calcareous rocks, remarkable for their natural cavities. Those wonderful stones of which the temple of Jerusalem was built, were of this nature, abounding in fossil shells. The pyramids of Egypt are also built of a species of oolite, which is full of small fossil shells, which were once thought to be petrified lentils, and other seeds, left by the workmen employed on these stupendous fabrics. This is nearly as philosophical a way of accounting for them, as the idea of Voltaire, who thought the fossil fish found in Italy were the refuse thrown away by the Roman epicures.

† We familiarly make use of these same laws, on many occasions of every day occurrence. If we wish to separate any dry ar-

sand upon one part of a coast, all equal in grain, and perfectly free from earthy particles: on another part of the same coast, and, perhaps, at no great distance, we find a similar extent of rolled *gravel*, almost entirely free from *sand*: on a third, a bed of the purest *clay*, perfectly free from *both*; and, perhaps, on a fourth, an immense accumulation of *sea shells*.

If, then, we allow for the action of those laws in the depth of the ocean, only on a scale infinitely more enlarged, and proportioned to the extent, both of the *material* and the *agent*, we shall find a much more easy and rational means of accounting for the geological phenomena on the surface of the globe, than all the wild theories yet formed by philosophy have been able to produce; and having this high additional value, that instead of opposing both *history* and *reason*, we follow the well defined track of both.

The most common source of error in forming our ideas on the formation of secondary rocks and soils, is our measuring the works performed by the *unceasing* action of the *laws of nature*, by the small and contracted scale of our own actions. Thus we almost instantly conclude, on observing a calcareous formation some hundreds of feet in depth, that it must have required some prodigiously long period of time to accumulate such a mass; whereas, when we consider the action of one great river, such as the Amazon, or the St. Lawrence, (remarkable, as all the American rivers are, for its muddiness, and tinging the ocean for 60 or 70 leagues from its mouth,) for a hundred years, and bearing, *night and day*, its prodigious load of mud into the sea, from whence it never returns; we must perceive that our ideas on such subjects are, in general, much too confined, and stand greatly in need of revision and correction. It is not yet ascertained to what depth it may be necessary to probe, before we come to the primitive surface; but it is highly probable, if not certain, that if we allow *a mean thickness of one mile*, for the whole secondary formations of our present dry lands, we shall be considerably over-rating their actual extent. We know that the most lofty peaks

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ticles in the form of a powder, but of irregular grain, we naturally shake it with a *lateral* motion, when the different sizes and weights of the particles become arranged; the finer always being found at the bottom. Every sportsman must be familiar with this law of gravity, as it is well demonstrated in the accidental mixtures of both powder and shot of different grains, which it is often necessary to separate.

are not more than five miles in height, and we have good reason to presume, that the greatest depths of the ocean are not widely different in extent. Now, in the four thousand years that have taken place since the deluge, during which a fresh series of secondary formations has been going on in the *post-diluvian* ocean, we must conclude that a much greater change has taken place than could have occurred in the sixteen centuries previous to that event; and yet we cannot discover changes to have taken place either on the lands, or in any part of the ocean, to lead us to the conclusion that formations to such an extent have occurred, even during this longer period. How then can we subscribe to those theories of philosophy, which attribute *immense periods* to the formation of each stratum, and which would imply, from a view of a few hundred feet of diluvial stratification, in such a chalk basin as that of Paris, a succession of revolutions, and of *salt* and *fresh water deluges*, occurring during an unnameable lapse of time? ‡

Certainly,— by y own theory.

Amongst the remarkable secondary formations of our European continents, there are few more worthy of our attention than the celebrated rock of Gibraltar, in which we find presented to our consideration a close connexion between diluvial animal remains, and the extensive fissures and cavities with which that rock has become intersected.

This mountain is completely isolated; having the sea on three sides, and, on the fourth, a low sandy plain or isthmus, of several miles in length, and about 900 yards in width near the rock, though its breadth increases towards the Spanish continent; whilst its greatest elevation, above the level of the sea, is not more than about ten feet.

The rock of Gibraltar is of an oblong form, and lies in the direction of north and south. The craggy ridge of which its summit is formed, is somewhat higher at the two extremities than in the centre. The whole rock is about seven miles in circumference, and forms a promontory of about three miles in length. Its breadth varies according to the indentations of the shore, but it no where exceeds three quarters of a mile. The most elevated point of this promontory towards the south, is called the Sugar Loaf, and is about 1440 feet above the sea; that towards the north is called the Rock Mortar, and is 1350 feet high; the signal house, which is nearly in the centre, is 1280 feet above the level of the sea.

The mountain of Gibraltar consists of a reddish-gray cal-

‡ And how then can your theory be [illegible] which subscribes all (secondary) [illegible] of the present [illegible] the deluge [illegible] [illegible] being greater than those of the 1650

careous rock, in regular strata, which may be examined with great accuracy in the north front, where there is a complete section of upwards of 1300 feet of perpendicular height. The strata are from 20 to 50 feet in thickness; and the whole mass is cavernous, presenting some of the most remarkable caves, adorned with magnificent stalactites.

I have been favoured with the perusal of a MS. account of the celebrated cave of St. Michael, in the rock of Gibraltar; and with the kind permission of its author, I cannot hesitate in presenting it to my readers, as it will serve to give a very just idea of the numerous similar instances of lime-stone caverns, which are to be found in so many other parts of the world.

The following extract is from a MS. journal kept by Captain Martin, while in the command of the late sir William Curtis' yacht, the Emma, on a pleasure cruise to the Mediterranean, in 1823 and 1824.*

"Having determined to explore St. Michael's cavern, I took ashore part of the crew, with a supply of signal lanterns, lines, Roman candles and blue lights: and Captain Paterson, an officer of the garrison, who had before made the excursion, joined our party, and was a great acquisition. We landed at the dock-yard, and immediately commenced our march towards the summit of the mountain. In about three-quarters of an hour we reached the stone platform in front of the cavern, which forms an esplanade for artillery.

"From this platform we overlooked the extraordinary line of fortifications, together with the villas and gardens, the town, the parade, the mole, the shipping at anchor in the bay, the city of Algesiraz, La Roche, and the distant mountains, the Ape's hill on the coast of Barbary, and the whole line of the two bold shores forming the straits, along to Ceuta: these objects, together with the deep blue pass, studded with white sails, completed the bird's-eye view, and formed one of the most splendid pictures that can possibly be imagined.

"We now commenced our descent into the cavern; and having proceeded about a hundred yards we halted to look about us. The roof of this apartment is supported in the midst of a stupendous pillar of stalactite irregularly fluted. The water, clear as crystal, but loaded with calcareous matter, was seen dropping from various parts, and exhibited the manner of this continual, but gradual formation, as, wherever it fell, a round knob of stony matter was upon the increase, instead of the *hollow* which would have been produced, had the rock from which it falls, been of the sand stone formation.

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* Should the author of this interesting MS. ever be induced to offer it to the public, it will exhibit the workings of a poetic mind and a graphic pen, such as have seldom appeared in our naval annals.

"The rays of light from the cavern's mouth, fall on a number of broken crags, and detached parts of pillars, plainly indicating their having experienced some severe shock as of an earthquake, as the points from which they have been shattered are distinctly visible.

"We now followed Captain Paterson into the second cavern, which was larger than the one just described; and I here lighted a Roman candle, which brought into view two most beautiful arches, the columns of which much resembled the pipes of an organ. Through the termination of one of these arches an aperture presented itself; and having made fast the end of a line, and left one of the crew at the entrance, we proceeded on our hands and knees, extending our line as a clue to our return. We thus crawled along a very considerable distance, till we found ourselves once more in an open space, but in darkness so thick that the rays of our lantern extended but a very short way, and above our heads was a void of indefinite extent. As we now stood in a groupe, afraid of venturing further, or of being precipitated into some horrible abyss, I suddenly lighted one of our blue lights, when the whole dome of this magnificent cavern burst at once upon our sight, tinged with the sulphureous hue of the brilliant flambeau I held in my hand. Pillar upon pillar, supporting mimic galleries, arch upon arch rising in Gothic elegance, seemed as if the sudden work of a magic spell, and sparkling with crystal and stalactite far beyond our reach."

(Simulaverat artem
Ingenio naturo suo: nam pumice vivo
Et levibus tophis nativum duxerat arcum.)

"A few feet from us was a well-like aperture, which Captain Paterson now invited me to descend by the aid of a rope; but this I thought it prudent to decline, satisfied with the magnificent scene before me. That gentleman had, however, formerly explored this cavity; and he described it as being about 50 feet deep, and terminating in a range of caverns similar to the one in which we then stood; and beyond these were other descents which never yet have been explored.

"We now retraced our steps, highly gratified with what we had seen; and as we emerged once more into the light of day, our agreeable sensations were much increased by the exhilarating contrast. Upon looking upwards towards the summit of the rock, I perceived the smoke which our flambeaux had occasioned, issuing out from among the shrubs; and being led by curiosity to climb up to the spot, we found a fissure in the rock, which, no doubt, communicated with those remarkable labyrinths, and through which aperture the currents of air were now clearing away the smoke produced by our lights.

"What a wonderful natural monument of former events is this extraordinary rock! A pyramid of huge stony strata completely honey-combed with caverns of this description. Its inaccessible and perpendicular face to the eastward, commonly called its *Levant side*, is perforated with innumerable fissures, opening, no doubt, into its interior recesses, and forming the habitation of swarms of apes and sea-fowl; while to the northward it is completely isolated from the main land by a long extent of sand, called the neutral ground.

"The view which we also had of this remarkable rock from the sea, was in the highest degree imposing. The swell of the waves rolling against its base, and rushing into its dark caverns, produced a melancholy sound; and I amused myself as we passed close in shore, in prying with my telescope into the mouths of these gaping chasms, within which I should suppose a boat could seldom enter, as the restless waters are agitated by the slightest breeze."

From the consideration of the mountains and the hills, in both of which we find strong corroborative evidence in support of what has been advanced, we now descend to the plains of the earth; and we there find, as might naturally be expected, so many additional traces of a former ocean, that every shadow of doubt ought to be removed from an unprejudiced mind. We have before remarked, that by far the greater proportion of the present dry land consists of plains but little elevated above the present level of the sea. We find no exception, in this particular, in any of the continents into which geographers have divided the earth; but in order to form a better idea of this part of our subject, we may refer to the descriptions given us by some of the most enlightened travellers of those *seas of land*, as they have sometimes been called.

Humboldt has given us, in his valuable book of travels, so interesting an account of the great plains of South America, that I shall here lay it before my readers:

"In the Mesa de Pajà," says he, "in the ninth degree of south latitude, we entered the basin of Llanos. The sun was almost at the zenith; the earth, wherever it appeared, was sterile and destitute of vegetation. Not a breath of air was felt at the height we sat upon our mules; yet, in the midst of this apparent calm, whirls of dust incessantly arose, driven on by the small currents of air that glide only over the surface of the ground, and are occasioned by difference of temperature, which the naked sands and the spots covered with herbs, acquire. These *sand winds* augment the suffocating heat of the air; every grain of quartz, hotter than the surrounding air, radiating heat in every direction. All around us the plains seemed to ascend towards the sky, and that vast and profound solitude appeared to our eyes *like an ocean covered with sea weeds.* Through a dry fog, and the strata of vapours, palm-trees were seen from afar, the stems of which, stripped of their foliage, but with verdant tops, appeared like *masts of ships discovered in the horizon.*

"There is something awful, but sad and gloomy, in the uniform aspect of these steppes. I know not whether the first aspect of them excites less astonishment than that of the chain of the Andes itself.

"Mountainous countries, of whatever variety of height, have always an analogous physiognomy; but we accustom ourselves, with difficulty, to the view of the *Llanos* of Venezuela and Casanary, and to that of the Pampas of Buenos Ayres and of Chaco, which recall to the mind incessantly, and during journeys of twenty or thirty days successively, *the smooth surface of the ocean.* I had seen the plains or *Llanos* of La Mancha, in Spain, and the *heath lands* that extend from the extremity of Jutland, through Luneburg and Westphalia to Belgium. These last are real *steppes*, of which man, during many ages, has been able to subject only small portions to cultivation. But the immense plains of South America are but feebly represented by those of the north and west of Europe.

"The course of the rivers in these vast plains, all branches of the Oroonoko, had once led me to think that they formed *table lands*, raised at least 100 or 150 fathoms above the level of the ocean. I supposed, in like manner, that the deserts of interior Africa were also at a considerable height, and that they arose one above another, like stages, from the coast to the interior of the continent. With regard to the Llanos of South America, however, I found, by barometical measurements at various points, *that their height is only from* 40 *to* 50 *fathoms above the level of the sea.* The fall of the rivers is so gentle, that it is often imperceptible; so that the smallest swell of the Oroonoko causes a reflux in those rivers of the plains which run into it.

"The chief characteristic of the savanahs, or steppes of South America, is the absolute want of hills and inequalities, and the perfect *level* of every part of the soil. This *resemblance to the surface of the ocean* strikes the imagination most powerfully, where the plains are altogether destitute of palm trees, and where the mountains of the shore and of the Oroonoko, are so far distant that they cannot be seen. This equality of the surface reigns, without interruption, from the mouths of the Oroonoko to Ospinos, under a parallel of 180 leagues in length (540 miles), and from San Carlos to the savanahs of Caqueta, on a meridian of 200 leagues, or 600 miles. The planters who inhabit the southern declivity of the chain of the coast, look down upon the steppes, which extend towards the south as far as the eye can reach, *like an ocean of verdure.* They know that they can traverse the plains for 380 leagues, (or for 1140 miles), to the very foot of the Andes of Pasto!"

The generally low level of North America is scarcely less remarkable than that of the South; but that country is so much more broken and irregular in the line of its sea coast, and so much indented by gulfs and inland lakes, that the plains are no where of such vast extent. However, the generally level state of that country is shown by the navigable rivers with which it is every where intersected, and from which the greatest riches of North America are derived.

In the extensive low plains of Carolina, marks of the former occupation of the sea are every where displayed. Extensive beds of oyster-shells are found at considerable depths, *alternating with strata of blue clay;* and the bones of monstrous animals are often discovered in cutting canals; these are the remains of the mastodon, and the mammoth, found in so many other parts of the world in similar situations.

From the new world we turn our eyes to the deserts and sands of Africa, of an extent and character not less remarkable. They have been described by Bruce, Park, and other travellers. *Pure sea sand* is there the prevailing soil, (if it deserve the name:) and though their elevation, above the sea, has not been so accurately measured as those of Europe, or of Asia, we may yet judge, from the currents of the Nile, and other rivers of Africa, flowing from the interior, that that continent is not, generally, of greater elevation than that of America, being crossed, however, by ridges, of very considerable height, in various directions.

M. Caillié, the enterprising French traveller, who, in 1824 and 1825, succeeded in penetrating to Timbuctoo, and was the first European who has ever returned to give us a distinct idea of that mysterious city, has thus described the desert of Sahara, which description will be found intimately connected with our present subject.

"A boundless horizon," says he, "expands before me; and we can distinguish but *an enormous plain of shining sand*, and, over it, a burning sun. We come occasionally to deep wells, full of *brackish* water. At a depth of four feet from the surface is found a gray sand, mixed with a little clay of the same colour. At the bottom of these wells there is often found a white kind of earth, resembling *chalk*, and mixed, occasionally, with some black or gray *rounded pebbles*. As far as the eye can reach there is no trace of vegetation; for hours in succession we did not see one blade of grass. The plains had *the precise appearance of the ocean; perhaps, such as the bed of the sea would have, if left dry by the waters.* In fact, the winds form in the sand undulating furrows, like the waves of the sea, when a breeze slightly ruffles its surface.

"At the sight of this dismal spectacle, of this dreadful and awful abandonment and nakedness, I forgot, for a moment, all my hardships, to reflect upon the violent convulsions which appeared *to have dried up part of the ocean, and upon the catastrophes which have thus changed the face of our globe.*"

This traveller states, that the trade of Timbuctoo, and, in great part, of all the interior of Africa, consists of *salt*, from the mines of Tondeyni and of Waden.

In Asia, we are equally struck with the great plains of China and Hindostan, which are of immense extent; but, from their richer soils, they constitute, in point of fertility, the most productive portion of the habitable globe. Some parts even of these, however, being composed of *sand*, or of *indurated clay*, are also completely barren: and the plains of the Cambul territory, extending four hundred miles in length, are of this desert description. The great *salt desert* of Persia stretches over an extent of about 500 miles, and is composed of a *reddish sand*, so fine as scarcely to be perceptible, and producing nothing but a few *saline* and succulent plants.

Arabia contains deserts of not less extent, composed of barren *sands* impregnated with *sea salt*, and totally destitute of rivers.* The very low level of these deserts, would cause them to be again inundated by the sea, by a very slight rise in its waters. The sub-soil, like that of most deserts, is a *grayish clay*, with a large proportion of *sand*, and containing *marine exuviæ*.

We find the following descriptions of the plains of Mesopotamia, in Buckingham's travels in that country. "The aspect of the country was dull and uninteresting; as there was neither *mountain*, *valley*, nor even *plain:* the whole being an unequal surface, like the high and long waves of a deep sea, when subsiding from a tempest into a calm: not a tree was any where in sight to relieve the monotony of the scene." The description of these plains by Xenophon, in his *Anabasis*, 2200 years ago, is strikingly correct. "The country," says he, "was a plain throughout, as even as the sea, and full of worm-wood: if any other kind of shrubs or reeds grew there, they had all an aromatic smell: but no trees appeared. Of wild creatures, the most numerous were wild asses, and not a few ostriches, besides bustards and roe-deer (or antelopes) which our horsemen sometimes chased."†

Mr. Buckingham, in another place, proceeds: "The people here have a particular and characteristic name for the desert, similar to that which we use for the wide expanse of the ocean, when we call it *the open sea*. In these extensive plains, minute objects are seen at quite as great a distance as on the ocean; and the smallest eminences are discovered by degrees, just as islands and capes are at sea, first showing their tops, and then raising them gradually above the horizon, till their bases appear on a level with the observer. The bearings and distances of wells are noted and remembered from such objects; and they are seen by caravans, slowly crossing the great desert, for many days in succession, as they approach to, or recede from them."*—*Buckingham's Travels*, vol. i. p. 237.

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* The camel is emphatically called by the Arabians the *Ship of the Desert.*

† In considering the diluvial nature of this portion of the world, in which the Paradise of our first parents is described to have been, it must be obvious to every one, that no such local descriptions of Paradise, as is found in our translations of the Book of Genesis, can consist with the total destruction of the antediluvian earth, and with our now inhabiting the bed of the antediluvian sea. That the discussion of this question may not now interrupt the general line of our subject, in this place, it may be satisfactory to the reader to know, that so great an inconsistency is not left unexplained, but that the 14th Chapter is entirely occupied by it.

In Europe, the most extensive plains are in Hungary, between the Danube and the Theiss. These plains have been computed by Humboldt to be about 3000 *square leagues;* and the line of division constituting the ridge between these two rivers, has been ascertained by accurate survey to *be only 13 toises* (or 78 feet) *above the level of the Danube.* Thus, it is plain, that a rise of from 200 to 300 feet in the waters of the Mediterranean, would overflow all the steppes of Russia, and connect that sea with the Baltic. The extensive peninsula of the Crimea, is in great part occupied by a vast undulating plain, or *steppe*, without wood, and mostly composed of *sand*, more or less mixed with clay. This plain abounds in *salt lakes* and *marshes*, from which salt is obtained during the dry season, for the supply of a great extent of country, and all the shores of the Euxine. Petrifactions, and marine exuviæ, are every where found in great abundance. The salt mines of Armenia have also long been celebrated.

If we turn our view nearer to our own shores, and contemplate the level plains of rich cultivation occupying almost the whole of Russia, Poland, Germany, France,† and Holland, we shall be satisfied of the correctness of the statement with which we set out; that the appearances which present themselves on the plains of every quarter of the globe, prove beyond a doubt, that they have, at no very distant period, formed a part of the bed of the ocean; and that a change of a very few hundred feet, in the comparative level of the present sea and land, would once more destroy by far the greater proportion of the habitable parts of the globe. We are not, however, from hence to imply that the *mode* by which the deluge was effected, was less the agency of a supernatural power. We are only to guard ourselves against the ideas of some theorists, who, in treating of this great revolution, lose sight of the comparative extent of the *whole globe*, and of its *aqueous covering;* and who think it necessary to break up the solid sphere of 8000 MILES in diameter, in order to produce the means of immersing a few thousand FEET of its surface.

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* "Travelling in Mesopotamia seems, even in the earliest ages of which we have any records, to have been little less dangerous than at present. Josephus, in his *Jewish Antiquities*, in relating that part of the history of Abraham, when he sent his chief servant from Canaan to Haran, to betroth a wife for his son Isaac, says: 'it was a considerable time before the servant got thither; for it requires much time to pass through Mesopotamia, where it is tedious travelling in winter, from the depth of the clay, and in summer, from the want of water; and, besides, it is dangerous, on account of the robberies there committed, which are not to be avoided by travellers, except by caution before-hand.'"

† The enormous collections of sea shells that exist in France, in Touraine, and at Grignon, have always attracted much attention.

We shall find, that the more we study geology and mineralogy, on an enlarged scale, and under the impression of the historical view, which informs us not only that the old earth *was to disappear*, but that it actually *did become overwhelmed by a flood of waters*, and that we are consequently now inhabiting a *new earth*, the very nature of which assures us, without the evidence of history, that it formerly was the bed of the ocean; the more easily we shall be enabled to account, in a natural manner, for the secondary formations and effects, now every where presented to our view. When we have once admitted that the primitive rocks were *created* without any connexion or assistance from the sea, of which they bear no marks; that the depression for the "gathering together of the waters" must naturally have given rise to the earliest secondary formations, in which no fossil remains are found; that in the course of upwards of sixteen centuries, many strata of a sandy and calcareous nature must naturally have been formed, with which the entire bed of the antediluvian ocean must have been encased; and forming heights and hollows of an easy and rounded form, as at the present day; and that at this particular period of the world, an interchange was to take place between the level of the *old sea* and of the *old land*,

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In the former instance there are said to be about nine square leagues, with a depth of about 18 feet, the whole consisting, almost entirely, of fossil shells. It is also said, that at Grignon, upwards of 600 species have been discovered.

by which preternatural operation, ordained for an especial purpose by the great ruler of the universe, these secondary heights and hollows were to become visible; from the moment we take this view of the subject, every thing on the earth becomes consistent, which was before confused, and in darkness: we can trace in our minds, the whole operation of mineral secondary formations, although we cannot be expected, always, to account for the various characters impressed upon different rocks, in the course of passing under the influence of the chemical processes of nature. When we thus acknowledge the *period* and the *mode* of the deluge, we have only then to discover, in our present rocks, what the particular formations were, which formed the actual *bed* of the sea, at that destructive period. When we have been enabled to do this, as we often can do most distinctly, (as, for instance, in the chalk basins of geologists,) we may be satisfied, that every thing we find *above* them, is the result of the action of the deluge, in the slow and gradual progress of which, during one whole year, the sea would continue to arrange and deposit the substances of every kind submitted to its action, in the same manner as at other times, only to a prodigiously greater extent, from the preternatural supply of the whole movable soils and productions of the antediluvian continents.* Nor must we permit our minds to be misled by the depth and extent to which these diluvial formations are frequently found. For though in our low lands we often cannot penetrate the total depth to which they extend; yet we must keep in mind, on the other hand, that, on our higher grounds, the rocks, in numberless instances, present at once the secondary formations which formed the bed of the sea at the deluge: and, consequently, that the whole movable soils of the old world are accumulated deeply in the *hollows*, or spread more thinly over the *plains* of the new. As a familiar instance of this arrangement, we may take the chalk formation of the south of our own country, and of the north of France, which broad extent of country, though now intersected by the channel, is obviously one great continuous secondary formation of the antediluvian sea, presenting a rounded and varied outline, without any naturally abrupt form.

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* "The bones of quadrupeds, already mentioned, are never found in the strata below the chalk, but always in the clay over the chalk." *Edin. Encyclop. England*, 713.

Let us then consider this great extent of chalk, (which, in France alone, is calculated at 16 millions of acres,) at the period of the deluge, when, as has been above explained, the interchange of level was to take place, either by the depression of the old lands, the elevation of the foundations of the old seas, or, perhaps, by the action of both these effects. This chalky accumulation of many centuries, continued below the surface during the early period of the deluge, the waters of which, turbid as they naturally must have been, deposited more or less of the new soils, over every part of it, both high and low, but, probably, to a greater depth in the hollows; the finer particles sunk, as usual, to the bottom; the grosser were moved about by the currents on the upper parts of these new formations, as they were deposited; the depression of the old continents gradually continued; until we at length arrive at a period of this interchange, when the tops of the round heights, in the chalk formation, came gradually to the surface of the waters, and were washed over by the waves. The operation proceeds; they gradually become more and more elevated above the level of the waters, which, as they sink, wash off any of the new soils which might have been deposited on the heights, and carry them again into the gulfs, to undergo a fresh deposit in a lower level. The tops and sides of the chalky elevations were then left nearly *bare, as we now find them;* while the whole movable matter of the diluvial waters became deposited in the basins or hollows. In tracing the sections of the chalk, which are visible on the sea coasts, we often discover such hollows similarly filled up;* and we can have no reasonable doubt, that the extensive districts now contained in the well-known basins of Paris, London, and the Isle of Wight, &c., are precisely of the same character, and owe their formation, and their richness of soil, to the very same cause and period.

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* There is an interesting section of a somewhat similar basin, presented to our view, on our own shores. On the coast of Kent, the chalk cliffs of the Isle of Thanet dip beneath the diluvial deposits about half a mile west from Pegwell, and they do not appear again upon the coast till a little way beyond Deal, in the neighbourhood of Walmer Castle. The borough of Sandwich stands in the centre of this diluvial section of a basin; and a branch of it, of a long, narrow form, divides the Isle of Thanet from the main land, and connects the diluvial formations of Sandwich with the Isle of Sheppey and the bed of the Thames, where bones of elephants, and other tropical productions, are constantly found in such abundance. The wells sunk at Sandwich, and in other parts of this plain, to the depth of from 50 to 130 feet, indicate many of the same species of diluvial strata to be found in London and at Paris. Blue clay, sand stone of various kinds, and many fossils, in the strata of clay and marl, indicate a succession very similar to that found in all such situations.

If any further proof of this were required, we should find it in the fossil remains of *quadrupeds*, *birds*, *fish*, *plants*, and *shells*, found in the lower strata of the Paris basin; similar, in many instances, to those found in the upper soils of the earth, which latter are unanimously admitted to have been lodged there by the diluvial waters.*

A section of this basin, (which has become more remarkable than numberless similar basins, merely from its situation near Paris, and its having been so minutely scanned by the distinguished Cuvier, whose theories, erroneous as they are, have been founded upon the phenomena there displayed), presents a numerous succession of distinct strata of sand, sand-stone, clay of many sorts and colours, marl, lime-stone, gypsum, burr-stone, and alluvial earths. In all these we find no formation of the same exact character, as the older sand-stone formations, or chalk, or other calcareous *gradual* deposits, *which formed the bed of the antediluvian sea.*

Cuvier remarks, that the quantity of *bones* embedded in the gypseous strata of Paris, is such as to be scarcely credible. In some parts of these strata there is scarcely a block

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Nor can we examine any great length of coast where the chalk is the prevailing formation, without observing, in the section presented to our view, numerous smaller instances of hollows or valleys on the old surface of the chalk, which have been filled up with soil, or strata of sand and gravel; all of which are to be attributed to the same diluvial action on a small scale. Several such small basins may be seen between Ramsgate and Kingsgate in the Isle of Thanet, and also at the village of Pegwell.

* "We shall conclude our account of this basin (of Paris) with an enumeration of some of the most remarkable organic remains which have been found in its various strata. Skeletons of unknown birds, elephant's bones, fish, and fish skeletons; leaves and parts of vegetables changed into silex: large trunks of palm trees converted into silex: skeletons of various quadrupeds: tortoise bones: bituminous wood; and nearly throughout all the various formations, oyster-shells."—*Edin. Encyclop. France*, p. 686.

The above enumeration is surely sufficient, of itself, to demonstrate the deposition of so extraordinary a mixture of land and sea productions at one and the same period, and by the action of one and the same agent.

that does not inclose a bone; and millions must have been destroyed, in the course of the old excavations, before these objects began to attract attention. The depth of the entire basin has never been ascertained, but it is calculated at about 500 feet.

Of the numerous species of fossils found in these various strata, we need only enumerate a few of the most remarkable, *and coming from the most opposite latitudes*, to show that this, and other such hollows, became the general deposits of every sort of *diluvial debris*, *arranged*, *however*, *according to the mode universally prevalent*, *within the influence of the waters of the ocean.* We find, then, a vast number of *marine fossil shells*, of which oysters form a prominent part. Some other shells, found in a formation where *vegetable fossils* also were, have been called *fresh water* shells; and thus, the two together, have given rise to one part of Cuvier's theory of *fresh water deposits.** There can be nothing surprising in finding fresh water shells, even if well ascertained to be such, in an accumulation of so varied a character; but their *presence* alone cannot support the extraordinary ideas of the above distinguished individual: and, besides, it is admitted, that the exact character of such shells is by no means clear. We find, amongst many vegetable fossils, the stems of *palm trees* in a petrified state. Of large quadrupeds, birds, and fish, there are many most interesting specimens found in the gypsum formation; and, also, the bones of *elephants*, *tortoises*, *crocodiles*, and other tropical animals, similar in character, and in species, to many of those fossils found in lime-stone rocks in England, and elsewhere; and in the basin of London."*

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* "Those terrestrial organic remains which may be considered as properly terrene, are presumed to be so, from their natures, and not from their situations; as they are found embedded in strata of *aquatic* origin, as well as in alluvial deposits, and occasionally in company with aquatic, in some cases, indeed, even with *marine* remains. They comprise quadrupeds, birds, reptiles, insects, and plants; and they bring us down to the last periods of the earth's change, which connect the most ancient living beings with those which are actually in existence.

"Remains of quadrupeds of various extinct genera or species, together with those of some birds and reptiles, are found accompanying fishes and shells in the fresh water deposits of the Paris basin. These are also accumulated in caverns, or fissures, more or less entangled in earthy matter. Under the same head may be also included the animals entangled in ice."—*Edin. Encyclop. Organic Remains.*

We here find, in the able article, of which the above is an extract, a distinct admission of analogy between all such fossils, wherever they are found in a mixed state: and it may be, perhaps, with confidence concluded, that no fossil, quadruped, bird, or plant, has yet been found, which may not be considered a deposit from the diluvial waters.

We can, thus, have no hesitation in attributing similar *effects* to similar *causes* all over the world: and if it may be safely laid down as a general principle in geology, that no remains of *terrestrial* animals or vegetables are to be found in formations *previous* to the Mosaic deluge, it must naturally follow, that all formations in which such fossils are now found, are of *diluvial origin*. We are, of course, to distinguish between such formations, and the animal and vegetable remains found so abundantly in the more partial deposits of marshes or lakes, which have taken place in the common course of things, and are now going on under our eyes.

We come to the same conclusions in considering the great deposits of *rock salt* and of *coal*, in every part of the world; on each of which it may be necessary to make some observations: for nothing more strongly marks the former presence of the sea upon our present lands, than the immense strata of rock salt now found in all secondary districts.

In England, beds of from 20 to 30 yards thick, are found in Cheshire, and in other parts. Spain possesses the celebrated rock-salt mountain at Cordova, which is nearly 300 feet high. The salt alternates with parallel beds of *clay*, *gypsum*, or *sand*. Near the same place is a promontory of red salt, 660 feet high, and nearly solid throughout. The whole Island of Ormuz, in the Persian Gulf, is said to be a solid mass of fossil salt. In South America the salt mines are numerous; and some are found in Peru, at an elevation of 10,000 feet above the sea; but even in these elevated regions, it is always associated, as in other countries, with secondary and diluvial formations of lime-stone, clay, sand, sea shells, &c.

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* In the above quoted able article on organic remains, in the Edinburgh Encyclopædia, amidst the general obscurity which unavoidably overhangs this subject, when viewed under the influence of existing theories, we find many gleams of light, all of which tend towards the very points for which we are now contending. The blindness of theorists to the imperfections and contradictions of their own conceits, is often exposed by the able author of that article: and the geological theories of Cuvier have not escaped remark, and able animadversion. After giving an account of some fossil fish found in a calcareous shale near the village of Stein, (where the Rhine issues out from the Lake of Constance,) 500 feet above the level of the lake, and which have been called fresh water fish by Saussure, probably from the vegetable remains also found in the same deposit, this author makes the following remark, which might be equally applied to many other parts of that article: "We can only say, that if this intermixture of marine and fresh water fish exists in this place, and if there is no error in the assignment of species, the geology of this district requires to be more carefully examined."—*Edin. Encyclop. Organic Remains*, p. 717.

As to the origin of these remarkable deposits, we may conclude, from the accompanying phenomena, that the salt has been deposited in hollows, on the retreat of the diluvial waters, and that the moisture has been evaporated or drained off in the course of subsequent periods.

That the waters of the ocean are found to be more richly impregnated with salt, the greater the depth from whence they are taken, is a fact which has long excited the remark of philosophers; and it appears highly probable that, from the greater specific gravity of salt water, a very extensive deposit of solid salt may take place in the greatest depths of the ocean itself. The reflux current in the Mediterranean sea is easily accounted for on this principle, that, as the waters are forced into it by the winds and the tides, and a great evaporation takes place from its inland surface, the impregnated salt water *sinks*, and being constantly supplied by the entering current, the lower strata, heavily charged with salt, are forced out again into the ocean, at a depth far beyond our observation.

We have a most interesting illustration of this fact, in an account given (in the 18th number of the Edinburgh Journal of Agriculture,) of the opening of the lake of Lothing, at Lowestoft, in Suffolk, on the 3d of June, 1831, when the new harbour was first entered by sea-borne vessels. The salt water entered the lake with a strong *under current*, the fresh water running out, at the same time, to the sea, *upon the surface*. This fresh water was raised to the top by the irruption of the sea water beneath, and an immense quantity of yeast-like scum rose to the surface. The entire body of water in the lake was elevated above its former level; and on putting down a pole, a strong under current could be felt, bearing it from the sea. At one place, there was a perceptible and clearly defined line, where the salt water and the fresh met, *the* *former rushing under the latter;* and upon this line, salt water might have been taken up in one hand, and fresh in the other.*

Mr. Cox, in describing the salt mines of Wielitska, near Cracow, in Poland, says, that the latter city is completely undermined, and stands, as it were, on pillars of salt. The strata of the whole mine are described minutely by M. Guetard, who says, that the upper surface, like a great part of Poland, is *sand;* then follows *clay*, occasionally mixed with *sand* and *gravel*, containing fossil animal remains; and the third stratum is calcareous rock, or gypsum; from all which circumstances he very naturally concludes, that this spot was formerly covered by the sea, and that the salt was deposited from its evaporated waters. All the above extraneous formations being evidently diluvial, like those at Paris, guide us to the exact period of this, and all other salt deposits.

It only now remains for us to take a general view of the *coal* formations, and endeavour to discover whether there is any analogy between them and those we have already been considering. The first striking circumstance in the coal fields, is, that *they have no connection with primitive rocks*, but, on the contrary, are always found in secondary and plain countries. They lie amongst sand-stones, clay-slates, and calcareous rocks, *but have, in no instance, been found below chalk*, which is one of the best defined secondary formations immediately preceding the deluge, as has already been shown. It is true, that in the unreasonable systems of *general* and *continuous* stratification over the whole globe, which so much prevail in the geology of the present day, coal is made to lie *far beneath chalk*, and is, consequently, supposed to be a formation of a much *earlier period.* Calculations have accordingly been made, as to the probable depth of *coal* beneath *chalk;* assuming, as a fact, that the dip of the coal strata continues in the directions we now find them to lie in different coal fields. Such calculations will be elsewhere shown to lead only to error and confusion.

The following passage in an able article of the Edinburgh Encyclopædia, on the geology of England, will serve to show, in the clearest manner, the general nature of the coal fields of our own country; and all similar fields may be traced to similar situations, by extending our views on a sufficiently large scale, and not being misled either by the dip of the strata, or by the nature of the embedding rocks.

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* Great quantities of fresh water fish perished on this occasion; one pike, however, of 20lbs. weight, had found time enough to devour a herring, which was found entire in his stomach.

"The principal coal fields, in the northern part of this district, lie in Northumberland and Durham; the West Riding of Yorkshire; and in Derbyshire. The strata of coal terminate a few miles north-east of the town of Derby, but make their appearance again to the south of the Trent, in Leicestershire, near Ashby de la Zouch: on the south-east, they terminate at Charnwood Hills; while, on the south-west, a thick bed of *coarse breccia* and *gravel* separates them from the coal fields in the county of Warwick."—*England*, p. 713.

"Although, as we have already remarked, the red sandstone rock cuts off the coal fields in general, yet, in some parts of Lancashire, and the western counties, detached coal fields *are surrounded by it.* All the strata of coal, and ironstone, in South Wales, are deposited in a *lime-stone basin*, the form of which is an irregular oval, in length 100 miles, and, where broadest, 18 or 20 miles. The upper stratum of coal is at the depth of 50 or 60 fathoms; the succeeding strata lie deeper, and are accompanied with paralleled strata of iron ore: the lowest strata at the centre range are from 600 to 700 fathoms deep." (This depth has, of course, not been found from *actual measurement:* 700 fathoms is not far from *a mile;* and it may be doubted, as is elsewhere shown, whether any secondary formations extend to so great a depth.) "In this basin there are 12 strata of coal from *three* to *nine* feet thick, and eleven others from eighteen inches to three feet, making in all 95 feet of coal. *The lime-stone that forms the substratum of this mineral deposition, appears on the surface all along the boundary of the basin, and is supposed to have an underground connexion, from point to point.*"—*Edin. Encyclop. England*, p. 714.

Nothing can be clearer than this account: and it appears certain, that as in the case of the Paris basin, this lime-stone formed the bed of the antediluvian sea, on which the diluvial deposits of coal, clay, iron-stone, and free-stone, were alternately laid at the same period. This being admitted, we have a natural means of accounting for the various inclinations in the parallel strata of such diluvial deposits. For, in the first place, they must have followed any inclinations that might have existed in the bed on which they were laid;

and, in the next place, we cannot conceive so great a mass of very moist materials becoming drained of their moisture, and settling down into a dry and hard state, by their own weight, without subsiding more in one place than in another; and we can thus account for those derangements in coal and other strata which always occasion trouble, and often much expense to the miner; and are called by the technical and provincial names of *troubles*, *hitches*, *nips*, *slips*, *&c.*

If any additional proof were wanting of the formation of coal having been occasioned by *terrestrial* vegetable substances, deposited by *marine action*, we should find it in the presence of the impressions of *fish* and *shells* in the strata of coal in Leicestershire. It may be said, that, as coal is called by geologists a *fresh water* formation, these aquatic fossils most probably belong to *fresh* water lakes; but this reasoning is not consistent with numberless other facts, exhibited in the coal strata, and which fully prove their connection with *the sea*.

There occurs also in the coal districts another difficulty, which is not so easily accounted for, although we may form some indistinct idea of it. This is, the solid *dyke* of a different mineral, which sometimes completely intersects the strata, and appears to have been *injected*, as it were, into a fissure occasioned by the subsidence above explained. We discover something analogous to these dykes, in the remarkable beds of solid flint, which intersect the strata of chalk, in every direction.* These dykes of flint, though they never extend to the thickness often found in the coal strata, are spread both laterally and vertically over a very considerable space. They are distinctly proved to be a formation subsequent to the chalk itself; and appear, like all flints, to be the petrified calcareous fluids drained from the whole mass in the course of pressure. It is not easy to account for the manner in which the strata of the chalk were sustained, and kept asunder, whilst the petrifaction of this juice was going on; but this, like many other such difficulties in mineralogy, does not affect the general question; nor ought the dykes of the coal fields to be advanced in opposition to the general principle of formation which we have now been considering.

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* During a residence of some time in a chalk district, on the coast, I have had an opportunity of paying some attention to the formation of flint; a subject which has never yet been duly explained, and which will, probably, long continue a problem in mineralogy. With regard to the actual composition of flint, I consider it clearly to be a petrified fluid drained from the calcareous mass, in a moist state. The perfect fluidity of flint, at one period of its formation, is distinctly proved, by the fossil shells often completely embedded in its substance, or preserved in the most perfect manner, attached to its surface. Shells, in a very complete state of preservation, and of the most fragile nature, are often found neatly filled with pure flint, even when at a distance from any bed, or nodule, of that matter, from which we might have concluded them to have been accidentally filled, like melted lead into a mould. This fluid matter, however, evidently did not follow the general laws of fluids, by retaining a horizontal surface; for I have, in my collection of fossils, some shells of echini, which I found to be half filled with chalk, and half with flint; the latter, with a rounded surface, and in a sloping position. The flint, in these specimens, is, also, quite unconnected with the only two

orifices by which the liquid matter could have entered from without; it would, therefore, appear to have originated within the shell. And this idea is further confirmed, by finding, in other beautiful and perfect specimens, filled with flint, that the substance is gently rounded outwards at the orifices, as if pressed in a thick gummy state from within; instead of being hollowed inwards, as lead is, when poured into a mould from without. I have also found, occasionally, that those nearly spherical nodules found in the chalk, are sometimes hollow, and contain, in the cavity, a yellow calcareous liquid, of the consistency of cream, and perfectly tasteless. The elongated and irregularly pointed nodules, are often found in the form of hollow tubes; within which, are sometimes minute crystals, and at other times, the matter has shot into long and delicate fibres, like hair, curiously interwoven. All these appearances in flint, distinctly prove it to have been a fluid, subsequent to the deposition of the chalk in which it is now found; and that it may, perhaps, properly be termed the juice of the calcareous mass, in the course of dessication, converted into stone, by those unaccountable chemical laws, which now govern the mineral world. The cause of the singularly irregular cavities in which the flints have been formed, and of their horizontal stratification in the chalk, must, for the present, remain subjects of conjecture alone; but, like the dykes in the coal strata, or the grottoes and fissures in lime-stone rocks, they do not in the least affect the general question.

POSTSCRIPT NOTE TO CHAPTER VIII.

While these sheets are preparing for the press, and while an opportunity is still in my power, I cannot permit it to pass without a few remarks upon an important paper on the *Coal Series*, lately read before the Yorkshire Philosophical Society, and which has now been published in the last number of the London and Edinburgh Philosophical Magazine (for Dec). This paper is upon the subject of "The Lower Coal Series of Yorkshire." It presents one of the many steps in the received systems of geology, which are *slowly*, but *surely*, advancing towards that very point for which I am now contending; and the few remarks I have to make upon it, will, I trust, go far to prove, that the hasty conclusions of the continental geology, on which our own schools have all been founded, have led to much contradiction and error, on this highly important branch of our subject.

It has, for some time, been one of the *well known facts* of geology, that, as trees and herbs could not, in any common circumstances, or by the common laws of nature, be deposited in a tranquil state *in the bed of the sea*, the extensive deposits we now discover in the form of repeated and alternating beds of coal, MUST *have been* deposited in *fresh water*; and, from this assumption, it has followed, that, wherever vegetable substances have been discovered, in the form of regular strata, even though occasionally accompanied with *shells*, such formations have received the geological name of LACUSTRINE *deposits*, as having resulted from the long-continued action of the *laws of nature in inland lakes of fresh water*.

This idea has, in a great measure, arisen, as I have elsewhere had occasion to show, from the deep-rooted error, that we are now inhabiting the same dry land which existed before the Mosaic deluge; and so misled have we in general been, by this delusion, that, wherever *shells* have been found in the neighbourhood of the coal strata, it has been assumed, as a matter of course, that they had belonged to such animals as then inhabited the *fresh water.* It must, also, be kept in mind, that, as there is often a separation of several hundred feet between the extreme limits of the beds of coal, and that, within that space, there are often *many* seams of that invaluable deposit, *each* assumed as having been the result of *immense periods of time*, as we may have naturally concluded, from the *invisible* (because visionary) progress of such deposits in the lakes of our own country, or in the rest of Europe; we are unavoidably led, by the adoption of such a theory, to discard *history*, and to adopt hypothesis; laying ourselves open, in such instances as I am now about to quote, to the vacillating effects, arising from distinct contradiction.

Mr John Phillips, the author of the interesting paper above alluded to, says: "The *lowest* portion of the Yorkshire coal strata, resting upon the mill-stone grit, produces comparatively but a small quantity of coal; and this, in general, not of a good quality. But no part of the coal-field is more curious in its geological relations, *or more worthy of close study, by those who desire to penetrate into the history of the production of coal.* We may define this lowest coal series very simply, by saying, that it is included between the mill-stone grit of Bromley, *beneath*, and the *flag-stone* of Elland, above, having a thickness of 120 or 150 yards, and inclosing, near the bottom, *two thin seams af coal*, one, or both of them, workable; and *several other layers scattered through its mass*, too thin to be worth working. The most regular and continous of all these coal seams, reaches, in a few places, to the thickness of 27 or 30 inches, but is generally only about 16. It is worked at various places, near Leeds, Bradford, Halifax, and Sheffield.

"It would have been impossible to have traced so thin a seam of coal, along so extensive a range, without some peculiar facilities—some *points of reference* more distinct than the varying quality of the coal, and *the still more irregular fluctuations of the* SANDSTONES *and* SHALES. This coal seam is covered by a roof, *unlike that of any other coal bed, above the mountain limestone, in the British Islands; for, instead of containing only the remains of plants, or* FRESH WATER SHELLS, *it is filled with a considerable diversity of* MARINE SHELLS, belonging to the genera *Pecten*, and *Ammonites;* and, in one locality, near Halifax, specimens of *Orthocera Ostrea*, and *scaly fish*, have been obtained from certain nodular argillo-calcareous concretions, called Baum Pots, lying over it.

The uniform occurrence of the Pectens, and Ammonites, through so wide a range, over one particular thin bed of coal, while they are not found in any other part of the coal strata, *is one of the most curious phenomena yet observed concerning the distribution of organic remains, and will, undoubtedly, be found of the highest importance in all deductions relating to the circumstances which attended the* PRODUCTION OF COAL."

Mr. Phillips then proceeds to give sections of the whole series, which, as in other coal fields, consists of alternating strata of sandy and argillaceous deposits, exactly similar, in their general character, to what I have already had occasion to exhibit; and containing, in several instances, the fossil remains of shells and plants.

He then continues: "In the upper coal series of Northumberland, Durham, Yorkshire, and Derbyshire, *are several most extensive layers of bivalve shells*, commonly called muscle-bands, and *referred to the genus Unio, from which the* FRESH-WATER *origin of those coal deposits has been inferred.* It was, therefore, with extreme gratification that I found, in passing through Mr. Rawson's colliery, at Swan Banks, in the midst of the series above described, TWO *layers of these shells, one of them about the middle of the series, considerably* ABOVE THE PECTEN COAL; *the other near the bottom, and considerably* BELOW *that coal.*"

Mr. Phillips then reasons upon the "PERIODICAL *return of the marine element into its ancient receptacle, after* THAT *had been, for some time, occupied by* FRESH WATER, *and its few inhabitants*," in much the same way by which the theories of Cuvier attempt to account for the stratifications in the Paris chalk basin.

After what has been already said on the more consistent and *historical* source of such deposits, it is only necessary, in this place, to add, that so unquestionable a proof of MARINE agency, in various parts of the coal basins of England, must shake to their foundations the theories of LACUSTRINE *deposits;* and, until it can be shown in our own lakes, or in those of the European continent, not only that such extensive ligneous deposits are *now going on in their beds*, but, also, that *distinct* STRATIFICATION can, under any circumstances, take place, *without the action of the tides and currents*, we must continue to look upon such vague and contradictory theories, as nothing better than empty dreams, which leave the mind in a confused and bewildered state, without the *reason* being able to attain any sound or solid ground upon which securely to repose.*

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* For further most important evidence on this subject, see the Supplementary *Note* to Chapter XI.

CHAPTER IX.

Organic Remains.—Evidences derived from them.—Erroneous Theories of Continuous Stratification. Diluvial Fossil Remains. Diluvial Origin of Coal.—Unfounded Theories on this Subject.—The Belgian Coal Fields.—Tropical Productions in Polar Regions.—Buffon's Theory.—High Importance of the Evidence of Fossils.—Natural and unavoidable mode of Transport.—Instances in Proof.—Buoyant nature of Bodies after Death.—Rate at which they might have been Transported.—The thick-skinned Animals floated longest.

Having thus found a further corroboration of the truth of Scripture, in examining the appearances still existing on the general surface of the earth, we now come to the consideration of a most important part of the evidence, by which the record is still further supported, and in a still more remarkable degree: I mean, that of the fossil remains of animal and vegetable productions, so abundant in the secondary and diluvial formations. This most interesting part of our subject is much too extensive to be here entered upon at great length; but as many of the *theories* of geology have been formed on the evidence of fossils, *viewed under a false light*, it becomes highly necessary to take a general view of the subject; and this general view may, perhaps, prove sufficient for our present general purpose: for it must be evident, that a few facts, unequivocally proved, and supported both by reason and by history, are of more value in leading to a just conclusion, than a thousand *theories*, however plausibly and ably composed, where both reason and history are directly contradicted.

The observations of the last half century, in various parts of the world, have served to give us a tolerably extensive view of this wide field for inquiry: but when we consider, that geology is but yet in its youth, and is only gradually rejecting the wild fancies of its more childish years; and, further, when we remember the comparatively few spots upon the surface of the whole earth, where we can have free access to a view of the interior structure in its upper strata, it may, perhaps, be worthy of admiration, that our knowledge is already so extensive as it is. As every day, however, adds to the number of ardent inquirers who bring in their stores of information, to add to the common stock, we may hope, in a short time, to obtain much more correct and certain data than we even yet possess, in order to secure the foundations of the whole structure, which have been, hitherto, but too generally laid in the sand.

In tracing the strata of the earth's surface, we discover, first, that *no organic substances exist in the primitive rocks;* nor do we meet with any marine remains until we rise several stages in the secondary strata. As we mount, however, towards the surface, the quantity of shells increases in some of the strata, while in others they are almost entirely wanting, as we may observe is the case in the visible parts of the present seas; but as we approach still nearer to the surface, and examine the rocks and soils which were formed at the period of the deluge, we find a vast increase in the fossil remains, and also a much greater variety in the species that have become embedded.

In the course of our examination into the *laws of nature*, by which secondary formations have been, and are still in the act of being formed, we found that it could not be expected that we should discover any fossil remains in the transition rocks, and but few in the earlier secondary formations; because, in the first case, the rocks so called, having been formed from the first fragments of the primitive earth, (by the depression of a part of which, the bed for the "gathering together of the waters" was first formed,) were arranged by the currents of the ocean, before that ocean became thickly peopled; and, in the second case, because the empty shells of the tribes, as they perished, would be comparatively few, for many years after the rivers and the ocean had been at work in forming secondary deposits. As time advanced, however, the sea would naturally become loaded with the shelly remains of past generations; and we should, therefore, expect to find a proportioned increase contained in the tenacious soils which have since been hardened into stone.

As we have seen that the laws which are in constant action in the waters, have a power of assorting and arranging different materials, in different and separate situations, we should expect to find shells more abundant in one formation than in another; and as we now find recent beds of sea sand of the most equal grain, and of vast extent, without almost a vestige of entire sea shells, we cannot be surprised on finding that the same law had obtained in the early sand-stone formations, and that freestone rocks are consequently, in general, destitute of these fossil remains; while the calcareous rocks, which, when soft and moist, must have been of a tenacious and muddy consistency, retain shells in extraordinary quantities. We have also found that there was little probability of discovering the remains of either fish or quadrupeds in the *gradually formed* secondary rocks, because, in the case of such deposits, the dead of both classes must generally have been devoured by the voracious tribes of the sea, before they could have been covered up and protected.

It has been too long and too generally the custom with geologists to reason upon the age of particular formations, from the nature of the fossils which they may be found to contain. We have thus arrived at many erroneous conclusions with respect both to the actual age of our globe, and to the *gradual* production of new species in the animal kingdom. As the whole science of geology may be considered to be founded on the evidence of organic fossils, it is of the highest importance on entering upon this subject to endeavour to correct our evidence before coming to a final conclusion. And it is, therefore, highly necessary to discover whether the theory of continuous stratification is well founded; and also, whether a distinct identity of fossil species can, in general, be traced in the same formations *in every situation*. On this most important part of the subject, I cannot produce stronger reasoning than has already been made use of by one of our most distinguished writers on geology and mineralogy; and the author of the very able article on Organic Remains, in the Edinburgh Encyclopædia. Although my opinions, on many parts of these subjects, differ widely from those expressed by this able writer, yet we here so completely coincide, that I shall not hesitate to introduce his line of reasoning in this place.

"It is now necessary," says he, "to examine a question which is strictly geological; namely, the nature and value of the evidence which fossil remains afford towards the indentification of strata, whether in the same, or in distant countries. Too much stress seems to have been lately laid on their utility in this respect; *a natural consequence of the enthusiasm which commonly attends the discovery of a new engine.* It is, in some degree, connected with the opinion which has been also held respecting the necessary identity of certain distant strata, and of *an universal or very general deposition of particular rocks.* The general question, as far as it is peculiarly of a geological nature, we dare not here enter upon, as it would lead us to a very long train of investigation; but we may state it, not only as our own conviction, but as now a prevailing opinion among all geologists, *that no proof of such* UNIVERSAL *formations, as they have been called, exists.* The arguments which would prove that opinion, from a *presumed* identity between certain strata mutually, *and that of the fossils which they contain,* and which, of course, presume on a succession of fossil bodies, as definite and constant as the corresponding successions of the strata, are open to many other objections, which we must now proceed to examine.

"Even admitting, that in two parts of the globe, which we shall here suppose polar and equatorial, the same strata, as to the materials and constitution of the rocks themselves, should exist, and be found also in the same order, it is not to be expected that the *same fossil bodies should occur in them, unless the differences of climate were considered an object of no moment.* If, in a weaker degree, yet the same objections hold good in those cases where the positions are far less discordant, as, even between the Mediterranean and the British channel, at present, we do not find a correspondence in the living species. In every situation, were we even to consider the animals only, the same reasons against such identity, among distant fossils in particular strata, exist; as we know that the different species inhabit different places irregularly, in colonies, or otherwise; and that even when mixed, they are limited to no determinate kind or number. If to this we add *the uncertainty of the strata themselves,* the chances of a concurrence become so extremely small, as rather to make us wonder that such a notion could ever have been adopted. *Many strata have been formed in independent cavities,* and are not likely to have corresponded in any respect; and at this moment, one species, the oyster, or the muscle, for example, is now an inhabitant of submarine alluvia of entirely different characters in different seas, *or even in different parts of the same sea.* There is no reason why the fossils of the Paris basin should be identical with those of the English; because the living animals may have differed. If the bottom of the English channel should hereafter become an elevated stratum, the variety of its fossils would confound all this reasoning.

"*Neither can the antiquity of beds be proved by the same reasons, unless we could also prove an absolute succession of species, or genera in creation;* and unless these recurrences were more constant and regular than they are, and than we have shown them to be, in former parts of this essay. We might, besides, to these add many more objections to the probable value of this criterion, from general considerations; but it cannot be necessary. With respect to its value in minor cases, when the strata in one deposit, such as that of England, are to be identified, the objections may diminish in *number*, yet, even then, these proofs *are not to be relied on*, as must be evident from what has just been stated with respect to living colonies, now in the surrounding seas. *That which would not identify modern submarine strata of mud, must not be expected to prove the identity of ancient strata of rock, formed under the same circumstances.* That it may afford occasional assistance, will not be denied: *but, to use a wrong method of solving difficulties is not only to deceive ourselves, but to establish or confirm false theories, and to stop the progress of all useful investigation.*

"It is evident, that to prove the identity of an *universal* stratum, one species, or set of species, must have existed all over the ocean where its materials were deposited. To prove the correspondence of strata less universal, a more limited degree of the same improbability is required. To prove that particular fossils determine the character and place of any particular stratum, *every species, or set of species, should have changed with the superposition of a fresh stratum:* besides which, it should never either have *pre*-existed or *re*-existed. But it is surely unnecessary to add to these arguments against this theory. We must, therefore, here drop the subject, and examine, in as few words as possible, by an enumeration of species and genera in particular strata, how the fact really stands. Conchologists, and those geologists who have studied this subject, will be at no loss to extend a comparison, which we shall render as distinct as possible, consistent with the necessary brevity; because *a few deficiencies in the evidence are sufficient to render the whole nearly, if not entirely, useless;*

and we need scarcely say how much we may be misled by thus trusting to what is imperfect or groundless.

"The lias of France, Spain, Italy and England, a stratum, or set of strata, well identified by their position with regard to the red marl, contains different fossils, in these several countries. *Echini are found from primary slate up to chalk;* as are tellinæ, turbines and chamæ. The belemnites, which are common in the chalk of France and Ireland, are rare in that of England; and the fossils of the chalk of Maistricht are almost peculiar to it. The vegetable remains that are found in the clay of Sheppey, do not occur in that stratum in other parts of England. *Crocodiles,* a fossil not a little conspicuous, occur in the lias, in the Portland oolite, in the green sand of England, and in the blue clay. Crabs, which are found in one of the earliest secondary strata, to wit, in the mountain limestone, also exist in the chalk, and in the London clay; as far asunder as they well can be. Madreporites, entomolites, pentacrinites, patellæ, ostreæ, ammonites, terebratulæ, gryphites, pectines, anomiæ, and numerous others, which it would be superfluous to name, *are found in nearly all the strata:* and so far is it from being true, that there are even any predominant associations of these, that *they occur, intermixed in every possible manner,* as will be more fully evinced in the general list hereafter given. It seems, therefore, quite unnecessary to pursue this subject further, since it must be sufficiently plain that *the evidence in question is worthless, or worse.*"—*Edin. Encyclop. Organic Remains,* p. 753.

I do not think it necessary to attempt to add to the powerful reasoning from facts, contained in the above extract. It must be evident to every candid inquirer, that it shakes to its very foundation the whole theory upon which the *indefinite age* of our globe is assumed; and we thus distinctly advance in the line of reasoning suggested by the earliest history of the earth, and by the action of the laws of nature every where displayed around us.

But it is in the monuments left us by the deluge, that we should chiefly look for the most abundant fossil remains of every kind; and we must begin the consideration of these remarkable monuments, by again alluding to what has been already said in the last chapter, respecting the origin of the strata amongst which coal and other fossil productions are invariably found. It has already been stated, that by far the most probable origin of the coal formations may be traced to the ruins of the whole vegetable world, at the period of the deluge; and in considering the subject of fossil quadrupeds from tropical climates, we shall find sufficient reason to account for the numerous palm trees and other tropical plants which have been found to exist in some of the coal fields. Some writers have endeavoured, indeed, to account for the coal formations, by the idea of *submarine forests of sea weed*, which they have supposed to exist in the depths of the ocean. Though there can be little doubt that many unknown wonders exist in these depths, and, amongst them many species of marine animals, with which we must for ever be unacquainted, and which, as fossils, we may look upon as extinct; yet we have no reason, from the specimens of marine vegetation occasionally thrown upon our coasts, to suppose that any thing like *trees* exists there. It may, indeed, be with confidence affirmed, that no unexceptionable specimen of a marine plant, embedded in rock, has ever yet been produced. The ground for supposing that all these numerous strata in the coal districts, ought, like those of the basins of Paris and of London, which contain no coal, to be included in *diluvial effects*, is, that from the number of months during which all things were fully submitted to the laws which act within the bed of the ocean, these laws had sufficient time to class and arrange the enormous quantity of movable materials so abundantly provided by that destructive event: and however difficult we may find it, to bring our minds to the conviction, that beds of many hundred feet might have been formed in the course of a few months, we ought to correct our confined notions on such subjects, by well considering the large scale of the whole earth, by which we have hitherto been measuring the phenomena on its surface.

In examining a section of the coal strata in the vicinity of Newcastle, we find the following result in a mine of 270 yards in depth.

	Yds.	ft.	in.
Covering of loose soil - - - - - - -	10	0	0
35 strata of different coloured *sandstone* at various depths - - - - - - -	177	1	0
16 strata of *clay* and *clay slate* - - -	72	2	8
16 strata of *coal*, of various thickness, from 2 feet to 6 inches - - - -	10	0	2
Yards	270	0	10

We thus find the strata, in this great coal field, composed *exclusively* of such sandy and argillaceous materials as were naturally to be looked for in the accumulations from the diluvial waters, during a continued action of several months. On examining sections of other coal districts, as in Staffordshire, and in Scotland, we find the same constant repetition of *sand-stone, slate-clay, fire-clay, argillaceous iron-stone, &c.* without, in any instance, intervening formations, such as chalk, containing shell fossils, or others obviously *of slow and gradual marine formation*, indicating a long period between the deposition of the different strata of coal. It has been already observed, that the coal fields are generally, more or less, in the form of a *basin;* and as the upper edges of these calcareous, or sand-stone basins, are in many instances traced round the whole circumference of the deposit; and as the same materials are, in such cases, found to form the bed on which the coal and other superincumbent strata repose, we have the strongest possible reason for concluding that the whole formed a valley or basin in the bed of the antediluvian sea, and received its contents, while that sea was depositing the whole movable matter of the former continents, with which, we feel satisfied, its waters must have been charged. In these deposits large trees are often found, *detached from the great strata of coal*, and extending *from one stratum through a variety of others*, which is sufficient proof of these strata, at least, having all been formed at *one period*. Some of these fossil trees are so perfectly petrified, that the roughness of the bark is distinctly seen, as well as the interior circles, which denote the yearly growth of the timber. At other times, the wood is *half carbonated*, like the *surturbrand* of Iceland. It is also a general remark in all coal districts, that the stratification which attends that fossil substance, *always terminates*, and is ill defined and disordered when it approaches any mountain range of primitive or early secondary rock. This is an effect which we should naturally look for, when we consider the nature of the *subsidence* of a moist mass of such extent, on being left to drain of its superfluous waters. For while that mass subsided more in one place than in another, and thus produced what, in the miner's phrase, are called *troubles*, *dykes*, and *slips*, we can easily suppose great disorder to have been occasioned where the mass touched the edges of the basin within which it was deposited; and where friction would prevent regularity in the subsidence for some considerable distance, and would consequently throw the whole stratification into disorder. That these *troubles*, *dykes*, and *slips*, are occasioned by such subsidence, is clearly proved by the well known circumstance in coal mines, that, even in such cases, each stratum usually retains its parallelism, with regard to those immediately *above* and *below* it.

We must feel satisfied, that, at the period of the deluge, the whole *forest scenery of the globe*, with the roots, branches, and foliage entire, must have been floated off upon the waters, matted together in groups, and forming immense islands, which must have been overwhelmed in confused masses, by the force of the waves, embedded at various depths, and covered up by strata, of various earthy and sandy composition, all which strata, having been subsequently placed above the level of the present seas, either by the depression of the former continents, or by the elevation of the bed of the former sea, (or by a combination of both these effects,) have been since drained of their former moisture, and have assumed the solid mineral substance which we now find so valuable.

It may be urged, in opposition to this idea, that such masses of vegetable substances would continue *to float* upon the waters for any length of time, and therefore could not be embedded at the depths we now often find the coal strata. But we are assured by daily experience, that though vegetable matter may float for some time upon the waters, it does not thus continue sufficiently buoyant for an indefinite period; but, on the contrary, becomes at length so completely saturated with water, as to lose its buoyancy, and to sink to the bottom, like any other heavy substance. We have, amongst many familiar proofs of this, one directly in point, which is described as now in progress, on a considerable scale, in some of the American lakes; where such collections of timber are, in many instances, being formed near the *embouchures* of the rivers which flow into them from the forests, that the extent, both superficially, and in depth, appears truly astonishing, and has been described as the incipient formation of future coal fields.

In the late survey of the boundaries between the United States and Canada, we have some interesting information on this subject. About 1000 streams of various sizes are described as emptying themselves into Lake Superior; and as sweeping into it great quantities of drift timber, which form *islands* near the mouths of the rivers. Within a mile of the shore, this lake is, in many places, 70 or 80 fathoms in depth; and within eight miles, it has been sounded 136 fathoms. The thickness of this lignite formation is, therefore, probably very considerable.

These accumulations are often at some depth under water; and it is probable that in the course of their long passage down the American streams, the trees become saturated with moisture, and arrive in the lakes in a state which causes them to sink, and accumulate in the manner described. In our own country we are so familiarised to floating *fir* timber in all our sea ports, that we are too apt to consider *all timber* as buoyant in a high degree. But when we extend our views to the immense forests of the *whole earth*, and consider the condition to which this forest scenery must have been reduced by the action of the deluge, we must be convinced that, on so great a scale, the buoyancy of the great floating masses could not have long continued; and that various succeeding masses must have sunk in the diluvial waters, at successive short periods, sufficiently distant, however, to admit of considerable intervening accumulations of earthy or sandy sediments, between the strata which were destined to the formation of coal.*

We feel satisfied that the plants and leaves now found in such abundance, impressed upon the strata in contact with the coal, and for a few feet distant from it, must have been embedded in a fine, soft clay, or mud; because their most tender stems are well preserved, and are often unbroken to a considerable length: and as many of these plants have been recognized as belonging to *tropical climates*, they must be judged by the same evidence by which the *tropical animals* now found in uncongenial climates can be proved to have been floated, by the currents of the ocean, from a southern to a northern latitude.† If, then, it can be proved, beyond a doubt, that the

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* For the most conclusive evidence on this part of our subject, see the Supplementary Note to Chapter XI.

† The species of fossil found near the coal, which has been called Lepidodendron, is very abundant, and is sometimes found of great size. Some specimens have been measured in the Jarrow Colliery, from 25 to 50 feet in length: and in the Fossil Flora, a specimen of this plant is mentioned, *four and a half feet in breadth.*

The unbroken *length* of some of the coal fossils has been urged as an argument against transportation, but without sufficient grounds. For if we consider the great floating masses of vegetation which must, in numberless instances, have been bound together at the period of the deluge, we may easily suppose that many of the reeds mammoth of the frozen regions never could have been an inhabitant of those regions, where its remains are now found preserved in *ice*, we must, upon the same evidence, conclude that all tropical fossil productions now found in climates unsuited to their growth, were lodged in their present beds by the same powerful agent; and that that agent was the deluge described by Moses; because neither from *history*, *tradition*, nor *facts*, have we evidence of any other such destructive event.

In Iceland, and also in the lately discovered Melville Island, in the arctic regions, remains of large trees have been found, more or less converted into coal; and in some cases the stems are only partially carbonized. In both these cases, they are of a size that bespeaks the produce of a very different climate from that in which they are now found; and they must, therefore, like other southern products, in northern latitudes, be attributed to the action of the currents at the period of the deluge.

Amber may also be mentioned as an antediluvian fossil, found more frequently in the northern than in the southern regions. It is not certainly known to what species of tree this gum must formerly have belonged; but it is evident, that it is the resinous juice of a tropical plant, in which insects have become entangled in the same manner as in similar cases, on modern trees. That it should be found more frequently in the *north* than in the *south*, is an additional evidence of the effects of currents; as from its great buoyancy in water, it would float for any length of time, and become embedded in the diluvial soils, from which it has subsequently been washed out by rivers, carried again to the sea, and thrown upon our coasts, or is found floating on the waters. It is, however, often found in its diluvial bed in France, and in Germany; and on many parts of our own eastern coasts, it is found associated with jet, or bituminized wood.

The above line of reasoning respecting stratification, must, no doubt, appear strange to all those who coincide with the following curious passage, to be found in a work intended

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or tough canes must have become deposited with the whole mass, in an unbroken state. Amongst other vegetable substances found in the mines of Northumberland, ears of barley, and leaves of pine-apples, have been noticed. Sometimes large trees extend *from one stratum into another*, one end of this petrified timber being of a different mineral nature from the other.

"for the use of young persons, who may desire to become acquainted with the elements of Mineralogy and Geology." In treating of the general geology of England, and after explaining the commonly received theory of general and regular stratification, this author proceeds thus: "In fine, a view of the geology of England assures us of the truth of the assertion with which we set out,—*that order in regard to deposition is universally prevalent*, and that this order is never inverted. Keeping in view this important fact, we, who reside in a country which is of the newest formation," (alluding to London, or its neighbourhood,) "might *amuse ourselves with speculations upon the distance which any one of the more ancient strata dips beneath our feet.* This can only be done *as a matter of curiosity, for we cannot even hope to approach the truth*, because of the uncertainty whether the numerous strata to the west of us *do, or do not, actually continue to dip towards the east*, any considerable distance beneath the surface; and even if we were to assume this to be the fact, *for the sake of amusing ourselves with a calculation of some sort*, we should still be at a loss as to the probable thickness of the several strata. Coal is one of the most important deposits, and therefore claims our consideration in as great, if not in a greater degree, than any other. We find, then, that the nearest place to London at which coal is found, is in the neighbourhood of Bristol, near which place it dips to the east, beneath the red marl. In this country its geological situation is between it and the mountain limestone. Now, its geological situation being beneath *the* red marl, we may observe, that there are very many formations, or strata, *supposing them all to dip together towards the east*, intervening, *between* THE *London clay and* THE *coal.* And when we recollect that the outgoing of the nearest coal is upwards of 100 miles from London; that the wells there pass upwards of 130 feet through the London clay, before we reach the sand which lies upon the chalk, from which sand the water of the London wells springs; *if* again we consider that, *between* THE *sand, and* THE *coal*, the numerous strata extend on the surface, over a tract of country about 40 miles in length from east to west, as from Hungerford to Bristol; and *if*, moreover, *we imagine* all these strata to be compressed beneath *the* sand which lies upon the chalk, *into one-twentieth part* of what their outgoings occupy on the surface; *we shall, even then, be compelled to suppose, that the strata of coal are more than* TWO MILES *be-*

neath the bottom of the London clay. How near the *truth* this calculation may be, or whether the coal, and all the intervening strata *between it and the chalk*, pass away beneath our feet, *we have no reasonable ground for concluding.*"*

Thus, because "*the* coal near *Bristol* dips towards the east three feet in six," there may be a possibility of the existence of the *same seam*, at the depth of several miles under the deep *London clay.* For it is too much to allow a loss of *nineteen twentieths*, in the calculation, by the compression of the strata; for, instead of being *compressed*, they must be supposed to be *expanded*, to occupy so much more room than they would all have done, had the whole series been found at Bristol. It seems scarcely necessary to remark upon the extravagance of theory contained in the above passage. Instead of taking *London* for our point of calculation, we have only to extend the idea a few hundred miles *still further to the east of Bristol;* and, including in our calculation all the strata of secondary rocks, upon which coal reposes at Bristol, and following up the same line of reasoning, upon the *continuous stratification of the earth*, what would be the result of our calculation? What a deformed and irregular mass would a section of the globe present, under such a theory? It would, in some rough degree, resemble the effect of Indian turning on a watch: the primitive nucleus of the globe would be entirely absorbed by the irregular *segments of circles* of secondary formation; and we should be utterly at a loss to represent the strata which lie in a *vertical position.*

When such theories as the above can be proved, to demonstration, to be founded in *reason*, and supported by *facts*, the page of the Mosaic geologist must, indeed, be forever closed.

With regard to the comparative level of the extensive chalk formation of the north of France, and the great coal field of Belgium, we have the most convincing occular demonstration of that of the former being *below* that of the latter. For if we follow out the section of the chalk presented to our view on the sea coast, proceeding from Calais in an easterly direction, we find the cliffs becoming gradually *lower*, as the whole country inclines to a lower level, until, at length, the chalk *dips from our view*, and we are launched into that immense sea of level alluvial plain, of which Holland and Belgium form but a small part. Now, when we trace the borders of the great chalk-formation in the north of France, proceeding inland from the neighbourhood of Calais, in a S. E. direction, we find, that, although, from the unbroken state of that country, we cannot perceive the actual dip of the chalk beneath the alluvial plains of Belgium, yet we must feel convinced, from the section of the coast which we had previously examined, that we may assume that dip with as much certainty, as if presented to our view throughout the whole line. It is in this great alluvial plain, then, that we find, in the neighbourhood of Brussels, all those proofs of diluvial ruin, precisely similar to what are presented to our view in so many other parts of the world. We discover, in great abundance, and at various depths, the remains of elephants, and other tropical quadrupeds. We find, in great abundance, both coal and limestone, without in any instance having to pierce the chalk, which we had *seen* disappearing under the diluvial strata, with a gentle dip and inclination. Here, then, we have another convincing proof of the nature of the deluge, and of the great chalk formation having formed at least one portion of the bed of the sea, at this destructive period; and yet, in the usually received opinions of geology, the chalk formation is placed far *above* that of coal, apparently from no better reason, than that chalk usually presents an *elevation* on the upper surface, while coal must be looked for at various depths *below* the level of the ground.*

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*Phillip's Outlines of Geology, page 219.

In giving a faint sketch of the scene that must have been presented, during the height and abatement of the deluge, I had occasion to notice the power with which the *currents* must have acted, in transporting the floating remains of animals and vegetables from one place to another, and the speculations which those fossil bodies have given rise to, in these latter times. There is, indeed, no part of geological research that appears to have been viewed in a more false light, or that has given rise to more wild and unreasonable theories, than the mode of accounting for the fossil remains of tropical productions, in climates quite uncongenial to their support in a living state. To account for the numerous remains of elephants in the *frozen regions*, theories have been formed to show that the climates of our planet have been changed, by a change or position of the earth with regard to the sun. Others have supposed, that the climates are now what *they ever have been*, but that the animals whose remains are now found in the north, *had a constitution fitted to a polar climate*, because some elephants have been there found to have hair upon their bodies, with which most modern elephants are usually very sparingly provided.

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* The actual depth of the chalk formation, is a point with which we are, as yet, very imperfectly acquainted. In the Isle of Thanet, in Kent, a well was bored for nearly 500 feet, in the idea of finding fresh water beneath; but as the chalk and flint beds were equally solid throughout, the attempt was abandoned. This bore was continued upwards of 400 feet below the level of the sea, and must have also been far below the sea-bed of the adjoining coast; for, in the straits of Dover, the greatest depths are only from 18 to 24 fathoms, (or from 108 to 144 feet). From this circumstance, we may, with certainty conclude, that the chalk formations of England and of France form one continuous bed of much greater depth than we can easily penetrate; and especially as it does not offer the same inducement to mining speculations, which are so often presented among other secondary beds.

The complete state of preservation in which they have been found, has also been advanced as a conclusive argument in proof of their having *lived* where they *died*, and having been *suddenly* encased in ice, by which even their flesh and blood have been completely preserved, like the bodies of insects in amber.

To give some notion of the extraordinary grounds upon which philosophers have sometimes founded their wild theories, we have only to glance at the idea of the celebrated Buffon, with regard to the changes of the climates of the globe; and all this extravagance of theory was to account for the remains of *tropical* animals in *frozen* regions; and, at the same time, to lend a helping hand to the ideas respecting the earth which he had previously promulgated. Buffon considered, that our earth was nothing more than a piece of the sun, struck off from its orb, by the violent collision of a passing comet; that it was driven into space in a state of red hot fusion, and thus gradually lost its native heat; that in process of time the latitude of Siberia became sufficiently cool for elephants, and other animals to live there; that when Siberia became, at length, too cold, they migrated to the southward, until they at length settled themselves, and became confined to the torrid zones. We are not told, by this distinguished naturalist, whence the elephants come; how the plants migrated, or how so many thousands of elephants showed so little of their celebrated and well known sagacity, as to have permitted themselves to be caught in the ice of the polar regions. This theory of Buffon holds out but a melancholy prospect to the animated beings now inhabiting the earth; as, in process of time, the whole must cool down to what the polar regions now are. Our only comfort, in such circumstances, must arise from the *millions of years* which the great theorist reckoned upon, for the cooling of so large a mass, and of which, we must hope, there are some few thousands yet to elapse.

Such are the grounds on which opposition to the sacred history has been raised!—and this within the last half century! On a foundation nearly equally unsound, have the subsequent theories of French geology been laid.*

As the whole question of the nature of the deluge, however, may be said to turn upon the subject of fossils, it must be admitted to be a point of the very highest interest, and, consequently, well worthy of the most careful examination. The great difficulty of accounting for these, and all other fossil remains of *tropical productions* in *northern latitudes*, appears to arise from the constant, but erroneous conception, that we are now living on the identical dry land which existed before the flood, *and which the Almighty had declared he would destroy, together with its inhabitants.* From the moment the subject is viewed in a proper light, and the conviction is secured, in the total disappearance of the old lands, and of our now inhabiting the dry bed of the former ocean, the difficulties vanish, and the whole subject becomes consistent and clear.

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* There cannot, perhaps, be a more proper place, than, after the exhibition of so impious and wild a theory of French philosophy, to remark upon the very common notion, from time to time revived amongst the weak and the ignorant in Europe, that a comet is to appear, and to injure, or utterly destroy the earth; and the year, and even the day, is sometimes named for this termination to our human anxieties. This idea savours much of that very fortuitous philosophy which we have found such reason to condemn. Can it be for a moment supposed, that the Providence of the Almighty Ruler of the creation is so imperfect, or obscure, or the mechanism of the universe so ill regulated, that a collision *can* take place between any of the heavenly bodies, and an accident arise from the derangement of the Divine work, as constantly happens in the most perfect of the weak inventions of man? When has such an event occurred, in the lapse of ages? In what part of the annals of astronomy is it described? On those who repose with confidence in an All-wise Providence, and who have faith in the inspiration of Scripture, and consequently, in the unerring truth of prophecy, such vain alarms will have no effect; for they know that the foretold events of Scripture are not yet nearly fulfilled; and that, till these events take place, and while the earth remaineth, "seed time and harvest, and cold and heat, and summer and winter, and day and night, shall not cease."—*Genesis*, viii. 22.

The first objects in this inquiry ought to be, to show, from physical facts, that a mechanical force does exist, the nature and action of which is, to transport floating bodies to a great distance, and, in many cases, in a *northerly direction.*

In a former part of this treatise, I have explained, in a general way, the nature and causes of the currents of the ocean, and have shown, that one great branch flowing westward, from the western coasts of America across the Pacific, passes through the Chinese seas with great force, accelerated, no doubt, by the opposition it meets with amongst the numerous points and islands. Here, then, is one mechanical power, by which floating objects would be, and no doubt are, transported from one side of the great Pacific to the other.

This same current, advancing westward through the sea of Bengal, and forced to double Cape Comorin, on the south point of that peninsula, is urged, *by the present form of the eastern coast of Africa,* in a *southern* direction, whereas, if this opposing shore did not exist, it would more naturally flow to the *northward* and *westward,* in the direction of the present European coasts. Here, then, is another part of the same mechanical power, which, if not prevented by the form of the present dry lands, and left free, as it must have been at the period of the deluge, *would transport floating bodies in a direct course from Asia towards Europe.*

If we still further follow out the courses of the currents, we discover another great branch called the *Gulf Stream,* rushing, with great rapidity, along the coasts of the United States, *from a southern to a northern latitude,* washing the coasts of Newfoundland; from whence it is forced, in a north-easterly direction, across the Atlantic, over to the coasts of Norway and the British Isles, and would, no doubt, have continued in its north-easterly course, towards the Arctic regions, had there been any free opening into the North Pacific Ocean in that direction. In the present state, however, of the sea and land, this current passes through the Bay of Biscay, and advances, southerly, towards the equator. Here, again, is an existing instance of mechanical power, by means of which *floating objects are now constantly transported from the tropical climates of America and the West Indies, to the northern shores of Europe.*

Mr. Pennant, amongst others, has remarked the variety of nuts, and other vegetable substances, which are thrown on the coasts of Norway and the Orkneys, from these southern climes; and also the mast of a British ship of war, the Tilbury, which was burnt *at Jamaica*, being thrown by this current on *the western coast of Scotland.* The same naturalist, also, speaks of the amazing quantities of drift wood from the American rivers, lodged on the *coasts of Iceland.*

In further proof of the general system of the currents, the following instances may be given, out of many.

A bottle, thrown overboard off Cape Farewell, on the 24th of May, 1818, from the Alexander, (one of the ships in Captain Ross's first voyage, in search of a north-west passage,) was picked up on the Island of Bartragh, in the Bay of Killala, in Ireland, on the 17th of March, 1819, having floated across the Atlantic, probably at a rate of more than four miles per day.

Some casks and shakes, (or empty casks taken to pieces, and packed tight, for the convenience of stowage,) belonging to the *Royalist* and *London* Hull whalers, which were both wrecked about latitude 61 degrees N., and longitude 56 degrees W., in 1814 and 1817, were picked up off the Butt of the Lewis, within a year of the time of these vessels being lost. And a shake that had belonged to the London, was found drifting through the Orkneys, about eleven months after the loss of that vessel. It had, therefore, performed the passage of 1600 nautical miles within that time, or, on an average, of five miles per day; and, in this instance, the transporting agent must have been quite unassisted by the winds, as these shakes are generally so soaked in oil, and are so heavy, that they float almost entirely under water.—*Scoresby's Arct. Reg.* vol. i. p. 208.

Mr. Scoresby, also, mentions a log of mahogany which was picked up at sea by Admiral Lowenorn, in 1786, when on his voyage to attempt the discovery of Old Greenland. "This piece of wood, which was so large, that they were obliged to saw it in two, before they could get it on board, they found in latitude 65 degrees 11 minutes N., longitude 35 degrees 8 minutes West of Paris. In the Danish settlement of Disco, is a mahogany table, made out of a plank drifted thither by the current; and it is now in the possession of the governor. A tree of log-wood was also picked up not far from the same place.

These logs of wood, the produce of the isthmus which connects North and South America, could only reach the places where they were severally found, by floating up the west coast of America, *towards the north*, through Behring's Straits, and so along the northern face of Asia or America, or across the northern pole."—*Scoresby's Arct. Reg.* vol. i. p. 7.

We have thus distinct instances produced by the above enlightened navigator and philosopher, of floating bodies being carried from an *equatorial* to a *frozen* region. Lieutenant Kotzebue found the current in Behring's Straits setting with great force *to the north-east*, and with a velocity of about two miles and a half an hour. If the same opportunities were afforded for scientific observations on the transporting effects of the currents, in the southern hemisphere, and in the unexplored or barbarous parts of the northern hemisphere, where European knowledge has not yet been introduced, there can be no doubt that these transporting effects would be as distinctly observed all over the earth, as they have been in the above instances. These are, however, fully sufficient to establish the existence of *a mechanical power of transportation;* and it would be both injudicious, and unnecessary, to endeavour to account for all the individual courses of the diluvial currents; for, as the lands by which these currents must have been influenced, no longer exist, the attempt could not be expected to terminate in any certain result.

Having now, however, found an agent, by which floating bodies are naturally carried *from a southern to a northern latitude*, let us follow the course of any animal body, such as that of an elephant, when deprived of life, *in a southern latitude*, and left to the influence of the natural currents of the ocean.

It is a well known part of the *laws of nature*, that an animal body, deprived of life by drowning, at first generally sinks by its own weight, and remains under water, until the *laws of decomposition* begin to operate. In the early course of this operation, and sooner, or later, according to the temperature of the atmosphere and the water, a quantity of *air* becomes disengaged;* and by this air, generated in the interior of the body, the whole becomes distended like a bladder, and rises to the surface of the water, by the same laws of gravity by which it had before sunk. The cause of this gaseous vapour, with which animal bodies become distended in the water, has not, perhaps, been yet examined with that careful attention which the subject appears so well to merit. It has been remarked by naval men, that when a body has sunk in a situation where no current is likely to remove it, it may be expected to appear floating on the surface, and in a shape any thing but human, about the ninth day after death, when a good look out is generally kept for its recovery. The time of such appearance on the surface, with regard to other animals, must, of course, depend upon their size, and the temperature of the water.†

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* "When the operation of *flensing* is completed," says Mr. Scoresby, "the tackle by which the whale was supported is removed, and the carcase, or *kreng*, commonly sinks; but sometimes *it is so swollen by the air produced by putrefaction*, that it swims, *and rises several feet* above the water.—It thus becomes the food for bears, sharks, and various kinds of fish."—*Arctic Regions.*

† It is a singular fact, well know to many naval men, that the bodies of unfortunate individuals, who have been drowned in a harbour, or other situation, free from currents, may be recovered *by the firing of cannon* in the immediate neighbourhood of the spot where they have sunk. Many successful instances of this experiment have been mentioned to me; and especially one, wherein the chaplain and a whole boat's crew of the Valiant, were upset in a squall, many years ago, in Torbay, and the whole unfortunate people disappeared. On the following day, an order was issued by the admiral, for each of the ships of the fleet to fire some guns, and, in about an hour afterwards, the whole of the bodies, amounting to 12 or 14, were found floating on the surface. A similar trial, attended by similar effects, was made with the guns of Sir Godfrey Webster's yacht, at Margate, when the body of a boatman, who had been lost, was thus recovered. The idea generally entertained of the cause of this effeet, is, that the concussion occasioned by the firing, breaks the gall-bladder, when a chemical process takes place, in which a quantity of gas is produced, which swells up the body, and causes it instantly to rise to the surface. Whether this be strictly correct or not, must be left for chemists to decide. This effect of concussion, however, certainly deserves more attentive consideration than it appears hitherto to have met with. It may assist in leading us to an explanation of the manner in which fish are known to be affected, at a great depth, by sounds; as porpoises, dolphins, and other larger fish, are known to be roused to unusual exertion and activity, by the

In the common course of things, a body cannot long continue in this floating state, because it is immediately attacked by birds or fish, and again sinks to the bottom, as soon as the skin is broken, and the air thus suffered to escape. In the interesting accounts of the whale fisheries, by Mr. Scoresby, we find that the bodies of whales are often seen in the manner above described, and buoyed up by the air generated in the operation of decomposition. That remarkable whale, the skeleton of which has so lately excited the wonder and admiration of every beholder in London, (the weight of which, in an entire state, was 240 tons, or 480,000 pounds, its length being 95 feet,) even this monster of the deep polar seas, was found *floating* on the surface of the water, off the coast of Belgium, and was conveyed ashore near the port of Ostend. This whale was, no doubt, brought into these temperate regions by one of the very currents we have lately been considering. When a whale is struck *dead* by repeated wounds of the harpoon, its body often sinks, if not immediately secured to the ship, or to the neighbouring ice. When this occurs, a look out is kept for some days, and the body is generally found floating on the surface of the water, and attended by great flocks of sea gulls, and sometimes by white bears, which soon destroy its buoyant quality, when it again sinks, to rise no more; and we may easily suppose that such large remains become gradually covered up by the *marine soils*, or secondary formations, and would thus prove sources of wonder and speculation, if there were a possibility of their ever being exposed to the eyes of man, which, however, we know, from the very highest authority, is never likely to happen, as it has been declared by the Almighty: "I will establish my covenant with man; neither shall all flesh be cut off any more by the waters of a flood; neither shall there any more be a flood to destroy the earth.—Genesis, ix. 11.

But during the awful event we are now considering, all animated nature ceased to exist, and, consequently, the floating bodies of the dead must have been buoyed up until the *bladders burst*, by the force of the increasing air contained within them. The stronger, therefore, the hide of the animal, the longer it would resist this internal force; and, consequently, we can,

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firing of cannon. The subject might also afford great additional assistance to the benevolent efforts of the Royal Humane Society, in the recovery of lost bodies.

without any difficulty, imagine the bodies of elephants, rhinoceri, bears, lions, and other large, coarse-skinned animals, floating upon the waters for several weeks, or even still longer, if they were rapidly carried into a cool latitude.

We have not many positive data on which to form a judgment as to the length of time *necessary* for floating a body from the equatorial to the more northern regions; but, as one instance, well authenticated, is as valuable for our purpose as many, I shall quote that mentioned by Mr. Granville Penn, of the "Newcastle, 60 guns, Captain Fanshawe, which sailed from Halifax, in Nova Scotia, on the morning of the 12th of December, 1821, and anchored at Spithead on Christmas day, having traversed a space of 3000 miles in *thirteen* days.* Had it not been for an interruption of forty-eight hours, occasioned by contrary winds, this distance would have been run in *eleven days*. The average progress, therefore, was 273 miles in the twenty-four hours; and on one of the days, the vessel actually ran 288 miles. As the wind blew almost a constant hurricane, *very little sail was carried*."†

We have here a recent instance of a large floating body following the direct line of one of the very currents which we have traced, (assisted, it is true, by a high wind,) and passing over a space of nearly 4000 miles in about eleven days, with very little assistance from artificial means. One glance at the map of the world will show that the same favourable current, and the same powerful wind, would, in a few days more, have carried the same body *into the polar seas*. Now, from the latitude of 20 degrees north, (or about the meridian of the centre of Hindostan,) to that of 75 degrees, (or that of the north of Nova Zembla and Siberia,) is not more than a distance of 3300 miles; and, therefore, even allowing for a smaller floating body than a ship of war, without much sail, we cannot hesitate in concluding to the *impossibility* of large inflated animal bodies remaining entire during a longer time than would be necessary for the passage of this distance, at a period peculiarly marked by storms and tempests. We are not, however, to suppose it probable, that the greater number of dead bodies reached a high northern latitude in an *entire* state. On the contrary, numbers must have sunk in every part of the temperate regions, and become embedded, piece-meal, in the rapidly accumulating diluvial formations where we now find them in a fossil state. But it must be admitted to be a remarkably corroborative circumstance, in support of this view of the subject, that, as the elephant, the hippopotamus and rhinoceros, are the animals, of all others, we should expect to float longest in an entire state, from the great strength and thickness of their skins, so they are the very animals now found in such vast numbers in the frozen regions, as to make their ivory a very considerable and valuable branch of northern commerce.

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* As the longitude of Halifax is 68 degrees west of London, the direct distance passed over by the Newcastle, must be fully 3700 geographical miles, or nearly 1000 more than Mr. Penn has calculated upon.

† Comp. Estim.

CHAPTER X.

High Importance of the Evidence of Fossils.—Siberian Mammoth.—The entire Elephant of the Lena.—Theories founded on this Specimen, unsupported by facts.—Consistent mode of accounting for Tropical Productions in Cold Climates.—Unchanged condition of the Climates of the Earth.—Italian Deposits.—Monte Bolca.—Fossils on the Coast of Norfolk.—Formations of the South of England.—The same View extended to the Continent.

We may now proceed to the consideration of some of the most remarkable fossil remains of quadrupeds that have been found in the temperate regions, and in such quantities in high northern latitudes, as to have given rise to much speculation and vague theory amongst philosophers, respecting the means by which they came into their present unnatural situations.

The bones of large quadrupeds have been observed, more or less, in all the quarters of the globe, where any attention has been paid to the search for them. In early times they were considered as the bones of the giants which were supposed to have formerly inhabited the earth. As mankind became more enlightened, these absurd opinions gave place to something nearer approaching the truth: it is, however, only within the last half century that science has applied that attention to the subject, of which it is so highly deserving; though the number of different opinions relating to these animal remains, proves how uncertain philosophers still are respecting them. The great attention of late paid to comparative anatomy, more especially in France, under that distinguished naturalist, the late Baron Cuvier, has greatly increased our knowledge of the different classes of animals, the remains of which are now found in the earth. But the geological views of that eminent man by no means kept pace with his zoological and anatomical knowledge. His theories of the earth, though exhibiting much talent, are all formed upon those very principles of *secondary causes* which we have found to be so objectional and unsound. His *numerous revolutions*, his *alternate salt and fresh water deluges*, all bespeak the school from which he derived his earliest geological ideas, and of which he himself latterly became the head. We cannot, therefore, with any consistency, or hope of profitable instruction, follow the track by which he would lead us to the origin of these fossil remains.

It is in the arctic and north polar regions of the earth, that some of the most remarkable and best preserved of these fossil remains have been discovered. There cannot, however, be a doubt, that if the south polar regions were equally accessible, we should also find their icy masses charged with the remains of the antediluvian dead. In Siberia, that barren region, so associated in our minds with tyrannical cruelty, solitude and desolation, where

> ———————— neque ullæ
> Aut herbæ campo apparent aut arbore frondes:
> Sed jacet aggeribus niveis informis et alto
> Terra gelu late,————————————
> Semper hiems, semper spirantes frigora cauri,

the great steppes, or plains, formed of a *sandy* and *gravelly soil*, intermixed with *salt lakes*, contain such quantities of the remains of elephants, that the fossil ivory forms a highly important and valuable branch of commerce. The natives of that country have given the name of *mammoth, or the mole*, to these fossil elephants; and, however strange it may appear, they look upon them as the bodies of animals *now living under the ground;* which idea is, however, founded on appearances and facts which render it in some sort plausible. For those who inhabit the northern regions, frequently find the remains of these large bodies still *fresh* and *bloody;* and as no such animals are ever seen on the surface of the ground in those regions, it is not unnatural for the ignorant peasants to suppose them to be a species of gigantic mole, which still lives and burrows in the earth. The able historian, Müller, who resided at Moscow in 1779, admitted that he was of the same opinion.

About the year 1799, a large object was observed by some fishermen, near the mouth of the Lena, on the coast of the Arctic ocean, to project from an icy bank, but beyond the reach of examination. For several following seasons the same object was remarked, and every year a little more disengaged from its icy bed, by the slow melting of the ice during the short summers. At length, in 1803, it became entirely detached, and the enormous carcase of a mammoth fell upon the sand bank below. This remarkable specimen was *quite entire* when it first fell, and the flesh so well preserved that it was greedily devoured by the white bears, and by the dogs of the fishermen.* In 1806, the remains of this carcase were examined by Mr. Adams, a member of the academy of St. Petersburgh, when the greater part of the bones, and a large portion of the skin yet remained. The brain was then still within the skull, but shrunk and dried up; and one of the ears was well preserved, retaining a tuft of strong bristly hair. The animal was a male, and is described as having had a sort of mane on its neck. As the description of Mr. Adams, however, was given nearly three years after the body fell on the sands, and as it had been partially exposed to the atmosphere during several years more, there can be little doubt that, if it had been dug out of its icy bed when first seen in 1799, we should have had a complete and minute description and drawing of one species of the antediluvian elephant.

Much stress has been laid by naturalists, whose theories of the earth required the aid of such evidence, on the remarkable shaggy coat of hair, with a species of wool at the roots, with which this antediluvian elephant was clothed: and it has been advanced, as a *positive proof* of the animal having *lived where his remains were discovered;* and, consequently, that he, and *thousands* of the same unwieldly race, the fossil bones of which are now found in such surprising quantities in the north, were all the *natural inhabitants* of these sterile regions, where no appearance of vegetation for their support is ever now produced.* But notwithstanding this thick coat of hair and wool, we have not a shadow of ground for supposing the animal which it covered, ever to have been a native of the frozen regions; because, in their present state, the soils of those climates do not produce the food necessary even for the smallest graminivorous animals, much less, then, for creatures of the size of the elephant, which are known to require the most luxuriant forest scenery for their habitation. It is admitted that no such scenery exists within many degrees of latitude of the Arctic ocean; and it must, therefore, follow, that no such animals could find the necessary sustenance there, *in the present state of the world.* This difficulty is, however, easily overcome by those who insist on the mammoth having been a native of the countries where we now find its remains. For they immediately change the position of the globe, and endeavour to show, that what are now the frozen poles, were made so by some unexplained convulsion, after having enjoyed all the luxuries of a tropical climate; and they further endeavour to prove, that this convulsion must have been *quite sudden*, as the flesh and blood of this fossil elephant were still preserved entire. The *supposed* suddenness of this *supposed* convulsion, however, proves more than is demanded or desired by these theorists; for, if this elephant, together with the very great number of elephants and rhinoceri, whose remains are found in such quantities all over the frozen zone, were *suddenly* encased in ice, and thus, from that instant, preserved as entire as insects found in amber, why is it that we do not find, in the descriptions of these icy masses, any mention made of the quantities of *vegetable* productions amongst which they *must have lived*, and which would equally have been preserved in the most perfect manner? We should, in such a case, have expected to have found, on the shores of the icy ocean, a complete antediluvian herbal, which would have settled all discussions respecting fossil vegetables found in other parts of the earth. We can in no way conceive a convulsion taking place, to produce *suddenly*, such effects as exist at the poles, without freezing up, and preserving entire, the forests and jungles, as well as the wild beasts contained in them: nor is it in the least degree probable, that the elephants and rhinoceri would have been singled out for preservation, amongst all the numerous species of animals which inhabited the same forests as themselves, whilst almost every other creature was suffered to escape.

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* It may appear to some, an improbable part of the history of this remarkable fossil, that any animal substance could have so long resisted decomposition, when acted upon by a solar heat, capable of melting the ice in which it was embedded. But it must be considered, that, in those high northern latitudes, as in the great atmospheric elevations of mountain ridges, in the regions of eternal snow, the air is of so rare and dry a nature, that the decomposition of animal substances can scarcely take place under any circumstances. It is true, that the direct rays of the sun act, in such situations, for a short time, with great power. But a general heat is never produced, such as occasions rapid fermentation in the equatorial and temperate regions.

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* I have seen the highly interesting portion of the skin and hair of this specimen, which was sent to Sir Joseph Banks, and is now in the museum of the Royal College of Surgeons in London. The skin is fully half an inch in thickness, in its dry and hard state, and must have originally been nearly an inch thick, and of prodigious strength. The hair is of three kinds, probably taken from different parts of the body. The longest is about a foot in length, of the nature of a thick bristle, and black in colour. The tufts of the second are of a dark chesnut colour, about four or five inches long, and of about the coarseness of the mane of a horse. The third kind of hair is of a dirty yellowish tint, and not more than about an inch long, closely covering the skin at the roots of the longest coat. Upon the whole, this hair presents us with the idea of a very rough and shaggy animal, of a dark brown, or chesnut colour, approaching to black, and which must, indeed, have exhibited a frightful appearance.

"There is not," says Pallas, "in all Asiatic Russia, from the Don, to the extremity of the promontory of Tchutchis, a stream or river, in the banks of which they do not find elephants, and other *large animals*, now strangers to that climate."* We no where hear, however, of either *fossil* or *recent luxuriance of vegetation* in these inhospitable regions, nor have we the smallest ground to conclude, that they have ever been less rigid than they now are, since the creation of the world; nor, consequently, that elephants, or other tropical productions, animal or vegetable, could ever have found subsistence there for a single day: nor will the undisputed fact of an elephant having hair on its body, afford us any conviction of its ever having inhabited so cold a climate: for though most of the present known species have but little hair, many of the most shaggy animals are natives of the tropics.

Pallas, in his Memoir on the remarkable fossils with which Siberia abounds, describes having there discovered *an entire rhinoceros*, the skin and flesh of which were preserved in ice, in the same manner as the specimen of the mammoth which we have now been considering: *but we do not find that this specimen was covered with a coat of hair.* Nor is it likely that so unusual a circumstance, had it existed, would have escaped particular remark and description by this philosopher.

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* Reliq. Diluv. p. 185.

To those who have well considered the condition of the earth at the period of the deluge, which has been so lately discussed, there can be no difficulty in accounting for the numerous fossil remains of tropical plants and animals every were found, more or less, in the upper strata of the globe; and that such remains should have been preserved *entire* in the frozen regions, towards which, I have shown, they would naturally be carried by some of the currents of the ocean, is only a consequence to be as naturally expected from such transportation. We must feel satisfied, that the elephant and rhinoceros would be, of all animals, *the most likely to float longest*, from their great bulk, and the strength and thickness of their skin.* If we follow the track which such large floating bodies must have taken, in a current flowing directly from the tropical to the northern latitudes; and if we consider that a *very few weeks* would, *at the utmost*, be necessary for their transport, as has been shown by the passage of a vessel, carrying little sail, over nearly 4000 miles in a similar course, in *eleven days*, we shall feel convinced of the *possibility* of their having been, in many instances, lodged in the icy regions of the north, with their skins *entire*, and their flesh and blood, consequently, preserved.

That those regions were *then* as cold as at the present day, is distinctly proved by the condition of the bodies themselves, which, with their icy covering, *must be in exactly the same state as when embedded four thousand years ago.* Why is it only in the colder regions that the *flesh* of these animals has been preserved, while in Britain, and in the other temperate climates, nothing but the bones remain, and generally in a detached and broken state? It is clear, that in the one case, the higher temperature of the soil has caused the decomposition of the softer parts; while in the other, the frozen state of the earth, at the depth of a foot or two, even in the heat of the short summers, has prevented decay;* and it must be equally evident, to an unprejudiced mind, that, in the course and prevalence of the waters upon the earth, and in so complete a wreck of animated beings, numberless bodies of every kind must have sunk and gone to pieces, and have become subject to the same laws of gravity and of fluids, by which we have seen that all movable bodies become classed and arranged in the bed of the ocean; while those that were floated off by more rapid portions of the currents, reached a higher latitude in a more entire state, where their subsequent preservation must have depended upon the temperature of the climates, where they became embedded.

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* In Siberia, there are found the fossil remains of buffaloes, of a very great size, and said to be larger than any existing known species. But this latter fact we have every reason to doubt. Mankind are at all times fond of the marvellous; and without recent bones, with which to make the comparison, those of the fossil buffaloe must appear very great. The fact is, that there are few quadrupeds of a more unwieldy growth, than the full grown buffaloe in its native tropical climate.

It appears certain, then, that on the subsiding of the waters of the deluge into their new bed, the floating bodies, in the northern regions, must have been *stranded* on the gravelly and sandy bottom of what was formerly the bed of the antediluvian sea; that they were, in many cases, sunk at various depths in this soft soil, agitated as its surface must have been by the slowly retiring waters; that the inclemency of the north soon congealed *into ice* the moisture that was not quickly drained off upon the surface; and that the bodies so hermetically sealed up, have remained in the precise condition in which they chanced to be, not only until our days, but will be preserved for any length of time, unless brought within the action of the atmosphere by the mechanical friction of rivers, or by other natural causes. It is also certain, that all other embedded bodies, such as vegetable productions, would have been equally well preserved, both in *substance*, and in *colour*, had they existed in any great quantity, as in *their natural soils;* and, that as no such vegetable productions are found in the ice of the north, we must conclude, that the northern regions never were different in climate from what they are at present; and, consequently, that they have always been equally unfitted for the support of both the animal and vegetable world.*

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* In the frozen regions, and near the poles, the heat of the sun, even during an unceasing day of several months duration, has so little power, that, at whatever depths trials have been made, the fissures in the rocks have always been found filled with ice, as eternal as that on the tops of the highest mountains. M. Patrin, who spent many years in Siberia, found this to be the case, on descending the mines of that country.

"The antiseptical effect of cold, in the polar countries, on animal and vegetable substances, is such as to preserve them unchanged for a period of many years. An instance corroborative of this remark, is given by M. Bleau, who, in his Atlas Historique, informs us, that the bodies of seven Dutch seamen, who perished in Spitzbergen, in 1635, were found twenty years afterwards in a perfect state, not having suffered the smallest degree of putrefaction."—"Wood, and other vegetable substances are preserved in a similar manner. Things of this nature have been met with in Spitzbergen, which have resisted all injury from the weather during the lapse of a century."—*Scoresby's Arct. Reg.* vol. ii. p. 344.

The conclusion at which we thus unavoidably arrive, with respect to any ONE fossil body, in the condition of the mammoth in ice, at the mouth of the Lena, involves the history of almost all the fossil remains of quadrupeds found in the alluvial soils in every quarter of the world. For if we can, *in any one instance*, prove that a production of a southern latitude has been transported to one very far to the north, in so short a space of time as to have its most destructible parts perfectly preserved, we cannot stop short in our conclusions: we cannot suppose *that* to be a solitary instance. On the contrary, we must attribute all fossil remains, both of animals and vegetables, now found in climates uncongenial to them, to the powerful agency of the same mechanical law. What, then, becomes of the lions, tigers, hyænas, elephants, crocodiles, tortoises, and other animals of tropical regions, whose remains are now found in every land indiscriminately, and often in confused heaps, deeply buried, in what was once the muddy sediment of a deluge, but now hardened into calcareous or other secondary rocks, and worked into cavities probably in the course of dessication? Are we to conclude, from the *entire elephant* found near the pole, which we feel satisfied could not have *lived* within many degrees of latitude of where his remains were discovered, that all the polar and temperate latitudes of the earth were once inhabited by a class of beings now unnatural to them? or because palm trees and cocoa nuts are now found, in a fossil state, in the strata of Britain, that they formerly grew there?* No. We are forcibly and irresistibly drawn to a directly opposite conclusion, by the concurrent evidence both of history, and of physical facts. We must feel a conviction, as strong as is possible, in any case, of which we have not had occular proof, that the same mechanical power which transported the mammoth of the Lena from its natural climate, to its icy bed in the frozen zone, must have also brought along with it, all the various fossil productions found in climates which would now be uncongenial to their support.†

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* It is much to be regretted, that the countries in which these most interesting and well-preserved specimens of fossil animal remains are alone to be found, are so situated, as to be beyond the convenient reach of philosophic eyes. For, although we only hear of the huge remains of the larger animals, because they naturally make the greatest impression upon the uncivilized peasants who discover them, there can be no doubt that the frozen regions must contain many other equally interesting and highly preserved remains, lodged by the diluvial currents: and it is probable, that if any journey were undertaken to the shores of the Frozen Ocean, for the express purpose of such research, the discoveries would amply repay the enterprise and trouble bestowed on the undertaking.

By the same line of reasoning, we are led to the solution of what has been one of the leading subjects of discussion amongst philosophers for the last century; that is, the remarkable accumulation of fossil remains at Monte Bolca, near Verona, in Italy. This deposit may certainly be regarded as one of the most interesting now known; and from the attention which has been paid to it, and the care and expence bestowed upon the collection of its fossil treasures, there are few with which we are better acquainted. The district, of which Bolca forms a part, is calcareous, and the quarries in which the most remarkable impressions of fish are found, consist of a stone of a schistose structure, and susceptible of being split into laminæ, or flags, of various dimensions. It is called, by mineralogists, a marl, or marley schist, and is of a yellow, white, or bluish gray colour.

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* Upwards of 500 kinds of seeds and fruits, many of which are now confined to tropical climates, have been found in the diluvial deposits in the Isle of Sheppey, on the Thames; and they are there associated with numbers of animal remains, of elephants, and other tropical quadrupeds. In Professor Buckland's collection, at Oxford, there are fossil and recent cones, of immense size; the former from the Portland quarries, the latter from a tropical climate.

† "In the valley of the Arno, parts of the skeletons of at least a hundred hippopotami have been discovered. With these were also found, in great abundance, the remains of rhinoceros and elephant, together with those of horses, oxen, several species of deer, hyæna, bear, tiger, fox, wolf, mastodon, hog, tapir, and beaver; they are from animals of all ages, and one of the elephants could not have been a week old."—*Reliquiæ Diluv.* p. 182.

The latter part of the above passage, respecting an elephant of not more than a week old, is probably intended as conclusive evidence of its having been born in Italy. But it is obvious, that the overwhelming calamity which deprived its mother of life, in a tropical climate, could not be expected to respect its tender age, but would, on the contrary, transport its remains to the latitude of the banks of the Arno, with as little difficulty or pity, as those of the still smaller animals, whose remains are now associated with it.

The most remarkable fossils of this deposit consist of fish, in a highly preserved state. In some collections that have been made from these quarries, there are from 600 to 800 specimens of various sorts, and of every size, from being almost invisible, up to four feet in length. Some of the species, which have, in all, been calculated at about 70, are recognized as being fish of the Mediterranean sea; others have been supposed to be now peculiar to the Pacific, and other southern waters. Some, however, are totally unknown.

This extraordinary deposit of fish has been the occasion of much speculation, and of many theories amongst naturalists, to account for its present elevation above the sea; and, like that of elephants in the polar regions, authors have endeavoured to account for it in various ways. The most generally received opinion is, though opposed by the most glaring inconsistencies, that, as a fish could not be so well preserved as those of Monte Bolca, unless thrown into their present position in a SUDDEN manner, their destruction must have been occasioned by a submarine volcano, before the great revolution happened, by which the present lands of Italy became elevated above the present seas.* It has been too often the

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*Amongst other proofs that the deposits in Monte Bolca were caused by a *sudden* revolution, we find an instance quoted, of a fish having another in its mouth, *yet unswallowed;* while others have the undigested remains of the stomach still visible. Had those instances related to *land animals*, instead of to fishes, who were naturally enjoying their own proper element, up to the very moment when the tides or the currents caused them to be suddenly overwhelmed by the muddy diluvial sediments, we should have at once acknowledged the force of the conclusion. But we have, in this, a remarkable proof, that a great proportion of the inhabitants of the deep must have been preserved alive at a time when almost all productions of the land were consigned to destruction. Had not this been the case, we must have found the fossil impressions of fish, in almost every direction, in our diluvial strata. But it is a well known fact, that fish, though abundant in some particular spots, are by no means common as fossils. In Dr. Buckland's fine cabinet of fossils, there is a good impression of a part of a large fish, with the scales of an undigested meal visible through the ribs. I believe this specimen is from Shotover, near Oxford, which has never been looked upon as a *sudden* formation.

custom to resort to volcanic agency, with regard to Italy in general, and to any such difficulties as were occasioned by Monte Bolca, in particular. The fact is, that few countries present more calcareous appearances than Italy; the greater part of the whole ridge of the Apennines, is composed of limestone and marbles of various kinds; and the existence of volcanic action, in such extensive secondary formations, as are found in Italy, exactly corresponds with what has been already remarked respecting volcanoes in general, and Iceland in particular, in an early part of this treatise. But about Verona, the whole country is calcareous, and Monte Bolca is admitted to be so, notwithstanding the above mentioned common opinion.

But we are led to the solution of this fossil mystery, by the same steps which guide us in our researches in other countries; and we thus find that Monte Bolca is only peculiar in the *quantity* and *beauty* of its specimens, and not in the manner in which they were deposited. When we hear of Monte Bolca, the idea of petrified *fish* instantly presents itself to the mind, so much more numerous are they than other fossils. But other fossils, nevertheless, exist; and such as are totally inconsistent with volcanic origin, under the waters of the sea. The bones of huge elephants, stags, and bears, and likewise those of the intermediate tribe, the *phocæ*, have been discovered; besides many terrestrial *plants*, *birds*, and *insects*.

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Here are evidences of diluvial origin, as clear as can be produced from any region of the earth; and the presence of the bones of elephants, or of other large quadrupeds, such as are found in the polar regions, surrounded, as in this instance, by *marine animals*, connect the two in a manner the most conclusive, and tend to the same point to which the Geology of Scripture, in all its parts, so consistently leads us. It is not, therefore, necessary, in such individual cases as we are now considering, to account for the accidental circumstances, which must have occasioned, in one instance, a preponderance of *terrestrial*, and in another, that of *marine* animal remains, in detached deposits. It is sufficient for the support of the general system which we are now considering, that, *in almost all instances of fossil remains of quadrupeds*, the two are more or less blended together, and in a manner to lead to the instant conviction, that sea and land productions had, by some means or other, become indiscriminately confused; and that they were thus left in a dry state by the retiring waters, the action and circulation of which had been the agent in this unnatural combination. The Mosaic History is alone capable of clearing up the obscurity of such phenomena; and it does clear away all difficulties in a manner the most satisfactory to the reason and understanding.

It may almost be considered unnecessary to proceed further in the production of proofs of diluvial effects upon animal and vegetable productions at this eventful period. But our own country presents so many examples of the highest interest, which are in a great degree unknown to general readers, that some further account of them may be desirable.

All geologists are well acquainted with the rich mine of fossil remains along the east coast of England; and especially in the counties of Essex, Suffolk, Norfolk, and Lincoln. An account of those on the coast of Norfolk has been kindly communicated to me by the Rev. James Layton, of Catfield, in that county, now resident at Sandwich, a distinguished collector of such fossil treasures; and as this account will serve to throw a great additional light upon the *effects* of diluvial action now under consideration, I shall proceed to lay it before my readers.

After describing the strata of blue clay, locally called mud cliffs, of which an interesting section is presented along that coast, exhibiting, in the clearest manner, the violent effects *of some diluviul eddy*, at that particular point, by the action of which the intermixture and contortions of the strata, as they were formed, took place; Mr. Layton proceeds as follows: "One remarkable feature in this compact blue clay, is a *stratum of wood*, exhibiting the *appearance of a wood overthrown*, or *crushed in situ*. At Paling, the stumps of trees *seem* now to be really standing; the roots are strong, spread abroad, and intermingling with each other: were a torrent to sweep away the mould from the surface of a thick wood, leaving the roots *bare* in the ground, the appearances would be exactly the same. This phenomenon occurs again at Hasborough, the line of crushed wood, leaves, grass, &c., frequently forming a bed of peat, extends just above low water mark. About this stratum are found numerous remains of mammalia: the horns and bones of at least four kinds of deer; the ox, the horse, hippopotamus, rhinoceros, and elephant. These fossil remains are fonnd at Hasborough, and its neighbourhood, on the denuded clay shore: at Mundesley they are found in the cliff. The great mine, however, *is in the sea*, some miles from land, where there is an oyster bed, on a stratum of gravel, about six fathoms deep. The sea gains rapidly on this coast; two yards at least every year. We may, therefore, conclude, that the land once extended considerably beyond that bed; and that the stratum of fossils was left, because they were hard and heavy, while the mud and sand have been carried into deeper water.

"How far this bed of fossils extends, I cannot pretend to say; but in 1826, some fishermen, while dredging for soles on 'the Knowl,' a bank *twenty miles off shore*, brought up an entire tusk of an elephant, which is now in my possession; it is nine feet six inches long, one foot nine inches in its greatest circumference, and weighs 97 pounds. It is cornuform, and exactly resembles the tusks of the mammoth, said to have been found in the ice in Siberia.* The elephants must have been *abundant*. I have at least 70 grinders, of all sizes, from four laminæ to twenty; and so various in their features, that, at first, I fancied I could distinguish a dozen different species; but I now believe that they all belong to the same, and that *most resembling the Asiatic*. Those which I now have, are reserved from more than *two hundred*, which have been in my possession; and the oyster dredgers reported, that they had fished up immense quantities, and thrown them into deep water, as they greatly obstructed their nets. Amongst these fossils, that is, from the oyster-bed, are some supposed to be of a species of the whale.

"In 1820, an entire skeleton of the GREAT MASTODON was found at Horstead, near Norwich, lying on its side, stretched out, *between the chalk and the gravel*. A grinder was brought to me, (it is still in the possession of Dawson Turner, Esq. of Yarmouth;) but so long after it was discovered, that scarcely any other part of the animal could be preserved. The whole had been carried away with the chalk, and burnt for lime, or spread in minute fragments over the fields.†

"Perhaps, I should also tell you, that upon this compact

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[*] The largest specimen of a fossil tusk that I have seen or heard of, it in the cabinet of Dr. Buckland, at Oxford, and was found at Rome. Is is but a small portion of what the whole has been, being not more than about two feet long; but, from its great size and straightness, it must have been of prodigious length, and of nearly four hundred weight. Its diameter is about 10 inches, and in its present decayed state, it much resembles a piece of fossil timber.

[†] For a further account of this fossil, see Chapter 12.

blue clay, so rich in fossils, is generally, but not constantly, a stratum of light blue clay, varying in thickness up to four feet: this is always delicately laminated; often having the appearance of the leaves of a book when pressed on one side. Above this are sand, (frequently stratified,) brown clay, gravel, and *chalk* RUBBISH, *intermingled, or alternating,* and surmounted by a deep rich soil. *These upper beds occasionally present* FOSSIL SHELLS, *probably from the crag stratum.*"

It is scarcely necessary to make any remark on the interesting and corroborative evidence of diluvial action, presented to us throughout every word of this singular and distinct account.

We here have every thing that the imagination can require, in painting the effects of a great DILUVIAL EDDY, collecting in its vortex an indiscriminate mixture of floating animal, vegetable, and marine productions, from every climate under heaven. The description of the *washed state of the roots of the trees* is particularly striking, as every one, who has seen a high land flood, bearing along its vegetable booty, must be familiar with the appearances which these fossil forests exhibit. But instead of single trees, we must endeavour to present to the mind's eye such *floating and matted forests,* as the wilds of America could still produce, in the event of a renewal of so awful a calamity; we must enlarge our views, in considering such vast effects; and imagine this portion of the diminishing waters of the deluge to be completely charged with a floating mass of objects, collected by the currents from "the four winds." We must endeavour to conceive, what mortal eye never saw, nor ever can see; and we shall then be fully able to elucidate and unravel the mystery which has so long overshadowed this awfully grand subject. The whole scene now presents itself to the imagination; and we are thus led to a period in the history of our native land, when its soft and chalky surface, for the first time, showed itself above the level of the waters; and when all its valleys and its basins first became the depositories of what we have so long speculated upon in darkness and in error, under the guidance of a false and theoretical philosophy. The same level of the waters, which deposited this mingled mass of organic destruction on the coasts of modern Norfolk, must have been extended over the whole of the south of England, and, also, over by far the greater part of the north. If we consider, on the great scale, the general structure of this southern portion of England, and follow out the formation of *the chalk* on which all these animal remains and diluvial strata repose, and *below*, or *in which no quadruped*, or *vegetable substance has ever yet been discovered*, we shall find, that from that very shore of Norfolk, and of the neighbouring counties of Suffolk, of Essex, and of Kent, ramifications of chalk, in the form of high bare downs, stretch from east to west, across the whole of this part of the kingdom; and in three well defined ridges, are known by the names of the Oxfordshire Hills, the Surrey Hills, and the Sussex Downs. Between each of these hilly ridges, *on which little or no soil is to be found*, excepting in the dips or hollows, which are *invariably* filled with *stratified diluvial clay and gravel*, we find extended plains of the richest soils, often of a depth which cannot easily be penetrated, and containing abundant animal and vegetable testimonies to their formation having taken place at the same destructive period when the strata of Norfolk became so charged with animal *debris*. To the north of the Oxfordshire hills, (one part of which, called Nettlebed, is considered *the highest point of England, south of the Trent*,) we find, in the vale of Oxford itself, numerous instances of the common diluvial strata, in the form of deep soil, gravel, clay of various kinds, and stratified rocks of a calcareous description, *full of sea shells*.

In one of these strata, the quarries opened up on the rising ground at Shotover, a few miles from Oxford, furnish a rich treasure of fossil animal remains; and it was from this place that one of the Saurian, or Crocodile tribe, was lately procured for the cabinet of Professor Buckland, on one of the bones of which *a large* OYSTER *is seen attached*, together with two *fine ammonites*, in their natural position. Those speaking witnesses of marine action could not have been produced on this *fresh water* animal, without its having been, for some time, subjected, like the bones of the mammoth mentioned by Cuvier, to the waters in which they naturally dwelt.

Now, if we suppose the level of the sea to have gradually, and in the course of weeks, sunk from the heights at Nettlebed, drifting off, as it fell, every movable substance, either animal, vegetable or mineral, into the lower levels, where they were submitted to the *lateral* action of the tides, and, consequently, arranged in stratified order, as has been before fully explained, and as always must happen in such cases; we shall have a clear and well defined idea of the effects observed in this and every other vale or plain in the south of England, formed almost invariably of the same materials and structure. By this means, we have a distinct conception of the *London basin*, situated between these same Oxfordshire hills, and the ridge of those of Surrey, to the south. By this means, we learn how the rich wealds of Kent, and of Sussex, came to be formed of such unfathomable depth of blue clay, marl, sand-stone, iron-stone, &c.; all reposing, in alternate strata, upon the chalk, which there can be no doubt extends below, from the Sussex Downs to the Surrey hills; and from these latter again, to those of Oxfordshire.*

By extending this line of reasoning to other parts of our own native country, and from thence carrying the mind's eye over the plains of France, of Germany, of Europe, and of the rest of the world, there is at once a full conviction presented to the reason, of the manner in which such *uniform effects* have been produced by so universal and prevailing *a cause.* The basins of Paris, of London, and of the Isle of Wight, so long the subjects of blind speculation and of error, must all have then received their load of fossil treasures; and then, also, might be seen the inflated and colossal forms of the animal kingdom, bending their gradual but certain courses towards their present icy beds in the Polar regions.

The work of destruction had at length been consummated; and the new dry lands were now to assume those forms and qualities, which experience shows us are so happily suited to the wants and comforts of postdiluvian generations.

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* The form and structure of the weald of Kent and Sussex, are, indeed, truly worthy of our most attentive observation. In outward form, there is the greatest variety of hill and dale, without, however, in almost any instance, being provided with the brooks or rivers, which, in other circumstances, we should look for as certain in every hollow. This peculiarity is obviously occasioned by the nature and extent of the prevailing clay, which, in many instances, is unfathomable. It is not a little singular, that coal has not yet been discovered in the wealds of Kent; for, as the soils and strata are almost every where identical with those of many of our richest coal fields, there can be no reason given for its absence from the iron and sand stone strata which so much abound, than that the diluvial waters, in this particular locality, were not charged with the same floating vegetable masses which they have deposited in such abundance in other more favoured places.

CHAPTER XI.

The Cave of Kirkdale.—Dr. Buckland's Theory founded on its Fossil Remains.—Contradictory Nature of this Theory.—Fossil Bones from the Hymalaya Glaciers, and from the Heights of South America.—Natural mode for accounting for them.—The Habits of the Elephant.—His most perfect form.—His love of the Water, and of a swampy and woody Country.—Habits of the Rhinoceros.—Cuvier's Opinion of Fossil Remains.—Inconsistency of this Opinion.—Evidence of Astronomy.—Evidence from Fossil Trees.—Conclusive Nature of this Evidence.—Evidence derived from Peat Moss.—Foot-marks of Antediluvian Animals.—Scratches occasioned by the Diluvial Action.—Formation of Valleys.—Scripture alone capable of explaining these Evidences.

There probably never has appeared any geological work, that excited so much attention and interest at the time of its publication, as the *Reliquiæ Diluvianæ* of Professor Buckland; in which that excellent and learned geologist endeavours to account for the fossil remains found in our own island, of quadrupeds which are now confined to much more southern latitudes.

It is with the most sincere respect for the well-known talents of Professor Buckland, that I consider it a duty, in this place, and while considering this part of my subject, to advance any thing in opposition to one whose opinions are so influential in the geological world. But the whole theory, under the impression of which that work is written, is so directly opposed to what has now been advanced, that I feel it due to myself, as well as to my readers, to make some observations upon it; not only in the fair support of an opposite argument, but for the sake of advancing, in at least a nearer degree, towards the same great end, to which all such inquiries ought invariably to point.

After describing the remarkable and indiscriminate mixture of fossil bones, found in a cave at Kirkdale, in Yorkshire, in 1821, Dr. Buckland proceeds with the following remarks upon the general theory of the fossil remains of quadrupeds.

"It was *probable*, even before the discovery of this cave, from the abundance in which the remains of similar species occur in superficial gravel beds, which cannot be referred to any other than diluvial origin, that such animals were the antediluvian inhabitants, not only of this country, but generally of all those northern latitudes in which their remains are found: the PROOF, however, was *imperfect*, as *it was possible* they might have been drifted or floated hither by the waters, *from the warmer* regions of the earth; but the facts developed in this charnel-house of the antediluvian forests of Yorkshire, demonstrate that there was a long succession of years in which the elephant, rhinoceros and hippopotamus, had been the prey of the hyænas, which, like themselves, inhabited England at the period immediately preceding the formation of the diluvial gravel; and *if* they inhabited this country, it follows as a corollary, that they also inhabited all those other regions of the northern hemisphere, in which similar bones have been found under precisely similar circumstances, not mineralized, but simply in the state of grave bones, embedded in loam, or clay, or gravel, over great part of northern Europe, as well as North America and Siberia."

"It is in the highest degree curious to observe, that four of the genera of animals, whose bones are thus widely diffused over the temperate, and even over the polar regions of the northern hemisphere, should at present exist only in tropical climates, and chiefly south of the equator; and that the only country in which the elephant, rhinoceros, hippopotamus and hyæna, are now associated, is in southern Africa. In the immediate neighbourhood of the Cape, they all live and die together, as they formerly did in Britain; whilst the hippopotamus is now confined exclusively to Africa, and the elephant, rhinoceros and hyæna, are diffused widely over the continent of Asia.

"To the question which here so naturally presents itself, as to what might have been the climate of the northern hemisphere, when peopled with genera of animals, which are now confined to the warmer regions, it is not essential to the point before me to find a solution. *My object is*, to establish the fact, that the animals lived and died in the regions where their remains are now found, and were not drifted thither by the diluvial waters from other latitudes."

In the Edinburgh Philosophical Journal, (in 1827,) a letter was published by Dr. Buckland, which he had received from Colonel Sykes, on the subject of hyænas dens in India; and the object of this publication was, to show the solidity of the foundation on which the professor's theory of the Kirkdale cave was built. This letter from India gives the exact description which we should naturally expect, of the *earth*, or hole of a carnivorous animal. A good many bones were found in it; but not more in proportion to the size of the animal, and the prey on which he usually feeds, than we always find in a fox's hole in our own country. I have lately had the pleasure of conversing with Colonel Sykes, and of discussing this, and other subjects of equal interest, connected with a tropical climate, and of the animals natural to it. His description of the hyæna is any thing but favourable to the theory of the cave of Kirkdale, even supposing that we had no stronger ground on which to combat it. He considers that the hyæna does not live in a gregarious manner; on the contrary, he never but once saw three full grown animals in the same hole; and he supposes that one of them was a young one, not yet expelled from the family, which always happens as soon as the young are able to shift for themselves. This is the well known habit of foxes and of wolves, between which, and the hyæna, there seems to be considerable similarity of character. Colonel Sykes inclines to think that they do not live so much in caves of a large size, as in fissures and burrows similar to fox earths; and that it is probable that they do not haunt even these, except when they have young; but lie out in the open country, or in the woods, as wolves are known to do.

In the earth which Colonel Sykes laid open, he chose one, which, from its beaten and used appearance, seemed a well established haunt; and in such a country as India, if such a haunt be not disturbed, or destroyed, it is probable that it may be so tenanted for many successive years. There was, however, no unusual quantity of *bones;* and such as were found, were of a very recent character. The abundance of *teeth* was entirely wanting; nor could I learn that there were any indications of hyænas, *who had died of old age*, having been devoured by their own species.

The learned professor then proceeds to state the differences of opinion that exist, on the subject of climate, amongst the highest authorities, and he mentions the opinion of Cuvier, that these animals probably had a constitution adapted to endure the rigours of a northern winter, which opinion was supported (and indeed was probably formed) by the "large quantity of wool" found, with the skeleton of an elephant, discovered in 1771, in the frozen gravel of Vilhoui.

He proceeds, however, with much candour, to state the opposing objections to such an idea, and to destroy both his own and Cuvier's theory, upon the very natural and unanswerable principle, that food could not have been found in those rigorous climates, proper for the sustenance of such large animals: he proceeds as follows; "for though the elephant and rhinoceros, if clothed in wool, may have fed themselves on branches of trees and brushwood, during the extreme severities of winter, still I see not how *even these* were to be obtained in the frozen regions of Siberia, which, at present, produce little more than moss and lichens, which, during great part of the year, are buried under impenetrable ice and snow; yet it is in those regions of extreme cold, on the utmost verge of the now habitable world, that the bones of elephants are found, *occasionally crowded together in heaps*, along the shores of the icy sea, from Archangel to Behring's Straits, FORMING WHOLE ISLANDS, COMPOSED OF BONES AND MUD, at the mouth of the Lena, and ENCASED IN ICE,* from which they are melted out by the solar heat of the short summer, along the coasts of Tungusia, in sufficient numbers to form an important article of commerce."—*Reliq. Diluv.* p. 46.

In concluding this *fundamental* part of his subject, on which, indeed, Dr. Buckland had before admitted that his whole theory entirely depended, he proceeds: "Between these two conflicting opinions," (viz. either that of Cuvier, that the animals had a constitution fitted to a colder climate; or that of other philosophers, who supposed the climates, now so inclement, to have been formerly warm, and the change to have suddenly taken place by an alteration in the inclination of the earth's axis, or by the near approach of a comet;*) "between these two conflicting opinions, we are *compelled*," says Dr. Buckland, "*to make our choice;* there seems *to be no third or intermediate state* with which both may be compatible. It is not, however, my purpose *to discuss the difficulties that will occur on both sides*, till the further progress of geological science shall have afforded us more ample information, as to the structure of our globe; and have supplied those data, without which all opinions that can be advanced on the subject must be premature, and amount to no more than plausible conjectures. AT PRESENT, I AM CONCERNED ONLY TO ESTABLISH TWO IMPORTANT FACTS; first, that there has been a recent and general inundation of the globe; and, secondly, that the animals, found in the wreck of that inundation, were natives of high northern latitudes, and not drifted to their present place from equatorial regions, by the waters that caused that inundation."—*Reliq. Diluv.* p. 47.

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* In order to trace such islands of bones and mud encased in ice, to their true origin, we have only to imagine the same kind of scene as we have just been contemplating on the coasts of Norfolk. And in order to disprove so obvious a cause, or to show that such effects are produced in the common course of things, as some have supposed, it must be shown in what part of the world such deposits ever now take place, and by what possible event the destruction of so prodigious a number of elephants, and other large quadrupeds, could, at any one time, have been effected: for it must be evident, that, had the mud cliffs of Norfolk been formed in the polar regions, we must have had the natural addition of ice, wherever they are now saturated with water.

The most remarkable feature in this part of the work of Dr. Buckland, is the very loose, and even contradictory reasoning, to be found throughout the above quotations. In one part, he considers it as *positively proved*, that the animals, whose bones are now found in Yorkshire, *inhabited England* "at a period immediately preceding the formation of the diluvial gravel in which they are embedded;" and that "IF they inhabited England, *it followed as a corollary*, that they also inhabited *all the other regions of the north*, in which similar bones have been found;" and yet he soon after states, that he "cannot see how even *branches of trees and brushwood* were to be obtained for their support, in climates now producing nothing but *moss* and *lichens*, which are covered with impenetrable ice during the greater part of the year."

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* It was a part of the theory of La Place, in his Systeme du Monde, that the stroke of a passing comet was the most probable cause of the Mosaic deluge. But, at the same time, he endeavours to allay those fears which were then, as now, so common, of a repetition of so dreadful an accident, upon the principle of the improbability of such a chance, in so wide a space as the heavenly bodies have to move in. How strange it is to find so great a mind incapable of appreciating the provident wisdom of an Almighty Creator, and conceiving that such supposed events were left to the guidance of chance!

The fact is evident, that the contradictory difficulties of such a theory were not concealed from the searching mind of the learned professor; who, however, leaves the whole question precisely in the same unstable condition, in which the mind is left bewildered by the theories of *first formations* by *secondary causes*. He admits the evident and close connexion between the fossil remains of quadrupeds, found in all countries; but though he sees the utter hopelessness of ever being able to provide the necessary food for *elephants* in the *polar regions*, he yet casts aside this *insuperable difficulty*, and twice presses the two important facts HE IS MOST CONCERNED TO PROVE, regardless of the contradiction in which he must, unavoidably, become involved in the attempt. I cannot agree with the learned professor, that the subject of *climate*, and, consequently, of *food*, was of secondary importance in the support of his theory; and there surely may be better means of "establishing *the fact*, that animals *lived* in the regions where their remains are now found," than by showing the *impossibility* of their finding the necessary food, which the professor not only perceived, but very candidly admitted.*

But the above reasoning of Dr. Buckland must appear the more remarkable, from his having, in a subsequent part of the Reliquiæ Diluvianæ, and in the course of most ably proving the inundation of high levels, fully admitted *the principle of transportation, or drifting of animal remains*, as the only possible means of accounting for the fossil bones found in the high elevations of Asia and America, and in the *avalanches* from the regions of *perpetual snow*. "With regard to the bones of animals," says he, "that perished by this great inundation, although they have not yet been discovered in the high Alpine gravel beds of Europe, (which is but a negative fact,) we have, in America, the bones of the mastodon, at an elevation of 7800 feet above the sea, in the Champ des Géants, near Santa Fe de Bogota; and another species of the same genus in the Cordilleras, found by Humboldt at an elevation of 7200 feet, near the volcano of Imbarbura, in the kingdom of Quito. If the animal remains of this era have not yet been discovered at such heights as these, in Europe, let it be recollected, that we have no elevated mountain plains like those in America; that our highest mountains are but narrow peaks, and ridges of small extent, when compared with the low country that surrounds them; and that if it were proved (*which it is not*) that the animals inhabited these highest points, it is more than probable that their carcasses would have been *drifted off*, as the greater mass of their gravel has been, into the lower levels of the adjacent country.

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* "Though the soil of the whole of that remote country (Spitzbergen) does not produce vegetables suitable or sufficient for the nourishment of a single human being, yet its coasts and seas have afforded riches and independence to thousands."

"The only plant I met with in Spitzbergen, partaking of the nature of a tree, (a salix, allied to the S. herbacea,) grows but to the height of three or four inches."—*Scoresby's Arctic Regions.*

"But in central Asia, the bones of horses and of deer have been found at an elevation of 16,000 feet above the sea, in the Hymalaya mountains.* The bones, I am now speaking of, are at the Royal College of Surgeons in London, and were sent home last year (1822) to Sir Everard Home, by captain W. S. Webb, who procured them from the Chinese Tartars of Daba; who assured him that they were found in the north face of the snowy ridge of Kylas, in latitude 32 degrees, at a spot which captain Webb calculates to be not less than 16,000 feet high: they are only obtained from masses that fall with the *avalanches*, from the regions of perpetual snow, and are, therefore, said by the natives to have fallen from the clouds, and to be the bones of genii."†

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* Dr. Buckland has given an interesting note from Gilbert's Annalen, 1821, in which a discovery by Lieutenant Kotzebue is described as follows: "On the western part of the gulf, to the north of Behring's Straits, a mountain was discovered covered with verdure, (moss and grass,) composed interiorly of solid ice. On arriving at a place where the shore rises almost perpendicularly from the sea to the height of 100 feet, and continues afterwards to extend with a gradual inclination, they observed masses of the purest ice 100 feet high, preserved under the above vegetable carpet. The soil is only about half a foot thick, and is composed of a mixture of clay, earth, and mould.

The portion of the cliff exposed to the sun was melting, and sending much water into the sea. An undoubted proof of this ice being *primitive* (*i. e.* not formed by any causes now in action) is afforded by the great number of bones and teeth of mammoths, which make their appearance when it is melted."—*Reliq. Diluv.* p. 46.

† I have had much pleasure and the highest interest in the examination of these bones; they appear decidedly to have been embedded

"The occurrence of these bones, at such an enormous elevation, in the regions of eternal snow, and, consequently, in a spot now unfrequented by such animals as the horse and the deer, can, I think, be explained only by supposing them to be of antediluvian origin, and that the carcasses of the animals were drifted to their present place, and lodged in sand by the diluvial waters."*

"This appears to me the most probable solution that can be suggested; and should it prove the true one, it will add a still more decisive fact to those of the granite blocks, drifted from the heights of Mont Blanc to the Jura, and the bones of diluvial animals, found by Humboldt, on the elevated plains of South America, to show that 'all the high hills, and the mountains under the whole heavens, were covered,' at the time when the last great physical change took place, over the surface of the whole earth."—*Reliquiæ Diluvianæ*, p. 222.

Now, it must be considered not a little singular, that this distinguished writer should at once admit the drifting of animal remains into the regions of perpetual snow, occasioned by *elevation in the atmosphere*; and, at the same time, deny the same mode of transport to those found in such abundance in the equally unnatural regions of eternal ice, occasioned by their *polar elevation*. It must be evident, that the two cases are perfectly similar. For, in order to elevate those fossil

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in lime-stone rock, of a gray colour; they are much broken, though not taken from a hyæna's den, and the hollows of some are filled with the most beautiful crystals. In others, these crystals have filled up the whole cavity with pure gypsum, of the whitest colour. It seems, then, probable, that the masses of rock in which they were embedded at the deluge, were torn from their lofty situations by the avalanches, as in our European Alpine heights: the bones are not easily assigned to their proper species, but one is evidently that of the horse.

* Mr. Temple, in his light and amusing sketches of Peru, describes some fossil bones found in the province of Tarija. They proved to be those of an animal of the elephant tribe, and probably the mastodon.

He says, "It is a subject of interest to inquire how these monstrous animals came into the valley of Tarija, surrounded, as it is, by a mountainous rampart, accessible, as I have been credibly informed, in only four places, and those with great difficulty, even to mules and horses. Over three of those places, the most frequented and most convenient in the whole rocky barrier, I have myself travelled, and certainly I do not think it possible that any elephant could have there passed."—*Travels in Peru*, vol. ii. p. 295.

bodies, found in the mountains of Asia, they must have *floated* on the surface of the waters; and, in order to effect the transport of such bodies to high latitudes, there was only required that power of *currents*, which may be (and, I trust, has been,) proved to exist at all times over the whole surface of the ocean. But this is only *one* of the many difficulties and contradictions which must occur in the course of supporting a theory so wide of the truth. One difficulty, for example, would be removed, with regard to the cave of Kirkdale, and other similar caves, in many parts of Europe, if we could hear, from the Cape, of any one instance of a hyæna's den, furnished in the same remarkable manner as the cave of Kirkdale in Yorkshire;* and there, surely, could be no great difficulty in doing this in our own colony at the Cape, "in the immediate neighbourhood of which the elephant, rhinoceros, hippopotamus, and hyæna, are now associated, and live and die together, as they formerly did in *Antediluvian Yorkshire*." We have many anecdotes and amusing accounts of all these animals, in the travels of that indefatigable sportsman, *M. Le Vaillant*, in that very part of Africa; but from his silence, and that of other naturalists, on this alleged habit of hyænas of amassing, from age to age, the broken remains of the very food they are said to be most fond of, we have the greatest reason to doubt that such a thing ever occurs. Both the elephant and rhinoceros are described by that author as swimming well, and being exceedingly fond of the water; rolling themselves in swamps for the purpose of defending their bodies from the flies by a thick coating of mud; and feeding on branches of trees torn from a height which no other animal can reach. But it seems unnecessary to search further into the difficulties and contradictions in which we become involved by adopting the theory of Dr. Buckland, on this highly important subject.

The following observations on the natural history of the Asiatic elephant may be found both amusing and instructive, while we are considering the nature and habits of that race of animals. They are taken from that most amusing work, "The Wild sports of the East," by Captain Williamson; and though the general tenor of that and of similar writings may, by some, be deemed frivolous, and uncongenial to the pursuits of the man of science and the philosopher, yet it must be kept in mind that, however the information obtained from such sources may be digested in the *closet*, it is from the *tented field*, with the sportsman and the native savage, that our first knowledge of these noble animals of tropical climates must originally be derived; and it may be, with justice, asserted of the beautiful work in question, that if all sportsmen in foreign countries could convey the results of their exhilarating pursuits with the same intelligence and judgment, we should soon have a fund of most instructive information upon many points in natural history, of which we have yet much to learn.

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* A collection of the fossil bones of quadrupeds has lately been discovered in a lime-stone cave in Wellington Valley, in New Holland. One of the bones was submitted to the inspection of the late Baron Cuvier, who ascertained that it was the thigh bone of a young elephant. We thus find that this new continent forms no exception to that general rule which is applicable to the other great continents of the earth; and that, though elephants have not yet been found there in a living state, their fossil remains bear testimony to the same transporting powers, which are so distinctly traced in our own more northern latitudes.

Captain Williamson's account of a *perfect* elephant is as follows:

"An elephant should have an arched back, a broad barrel, the hind quarters full and square, the hind legs short and firm, the toe nails thick and black; and, to please a native, there should be five on each forefoot, and four on each hind foot;—odd numbers are considered by them unlucky. I have known some with 15 nails, which no one would purchase; and I have heard of one with 20; but never saw one with more than 18. The tail should be long, very thick at the insertion, and tapering well towards the end, where it should be well furnished on each side with a row of single hairs, or rather bristles, for about a foot, forming a fork at the end, and resembling the feathers or wings of an arrow. This circumstance respecting the tail is considered by the natives perfectly indispensable; for a short tail, or a broken one, or a want of hair at the termination, are formidable objections. No man of consequence would be seen on an elephant whose tail was devoid of hair; and particularly if broken short, as is frequently the case. This latter deficiency is owing to a habit elephants have, in a wild state, of seizing each other by the tail, with their trunks, and twisting them off, sometimes very close to the croup. Even servants of inferior degree are averse to ride on an elephant so blemished. The chest should be wide and full, the fore legs muscular and well turned; the forehead broad, and ornamented between the eyes, with a protuberance gracefully harmonizing with the surrounding parts. The top of the head should be thickly set with hair, carried high and square; the trunk thin, and very elastic; the teeth of males should be exactly alike, thick and long; they should diverge from each other, so as to be rather more distant at the tips, than at the insertion; and with a graceful curve. The ears should be large, and free from raggedness at the edges; the cheeks full; and, above all things, the eyes clear of specks and rheum."

An elephant, having all these rare perfections, and from nine to ten feet high, is worth 8 or 10,000 rupees, or upwards of £1000.

"Elephants are generally black; but few of them entirely so; many are sprinkled over the ears, trunk, jowl, shoulders, and legs, with dun coloured spots, which are far from displeasing. The Nabob Vizier had one, which was called *white;* but it was really *dun.* It was *unique* in Bengal; but I have been informed that in Ceylon they are by no means rare."

"In some years, very few wild elephants can be found near the sea coast, whence they retire into the immense jungles which lie between Chittagong, and the Chinese frontier. At other times, the coasts are overrun with them, to the utter ruin of the peasants, whose crops and plantations are often destroyed in the course of one night. This generally happens in a dry season, when *want of water, and of succulent herbage,* in the interior, causes the herds to descend to the ever verdant plains bordering the sea, where the diurnal breezes inspire fresh vigour."

"Nature has wisely proportioned her *animal* to her *vegetable* productions. Thus we find the districts furnishing elephants, replenished with immense tracks of high grass, and abounding in lakes and streams; without such ample stores, such stupendous animals as the elephant must perish. For, exclusive of the large quantity of grass, &c. which an elephant daily consumes, his broad feet will destroy immense qantities. As to his thirst, which requires both frequent and copious libations, the ordinary puddles, such as furnish a supply for cattle, would by no means answer. *The elephant, like the buffaloe,* DELIGHTS IN WALLOWING, and never thrives so well, as when he is allowed to visit a rapid stream, there to exercise himself in swimming, as well as to lie immersed in the water."

"Chittagong elephants, growing to a much larger size than those to the North, or Nepaul district, and being of a more substantial form, are peculiarly valuable to those who catch elephants with the *slip knot*, or *phaun*. The only objection is, their want of speed. They are more healthy *after being seasoned to the climate of the Nepaul country*, while the native elephants of that northern climate are extremely deficient, not only in the three grand points, viz. *stature*, *strength* and *beauty*, but in *constitution* also. Hence they are of much less value than those of Chittagong, Tipperah, and Silhet."*

"The Ceylon breed far exceeds that of the continent; and it becomes a curious and interesting question whence Ceylon was first furnished with elephants, there being none on the opposite shores, nor to be found in all the great peninsula, from the west bank of the Ganges to the Persian Gulf! Besides, the generality of the Ceylon elephants are of a *brown*, or *dun colour*."

"Elephants are natives of a *wet soil*, and, in the wild state, feed on very watery aliments. They also take great delight in ranging among *swamps*."

"They rarely exceed nine feet in height. The tallest ever found in Bengal, was the *Paugul*, or mad elephant, (about 1780). It was nearly 12 feet high; but the medium size is from seven to eight feet."

There is no definite mark by which the age of the elephant can be known. We can only judge by his general appearance.

While we are thus instructed, by this active and intelligent sportsman, on the subject of the elephant in its wild state, I shall here also extract the few particulars he was enabled to give, on the subject of the haunts of the rhinoceros, an animal whose remains are also now found in a fossil state in the northern and temperate regions, and frequently in the same situations, *though never in the same abundance* as those of the elephant. We shall find that this wild and very mischievous and savage animal is equally a native of the hottest and most wooded countries; and we, therefore, come to the same conclusion with regard to it, that we have reached with regard to the various races of elephants, viz. that it never could have been the inhabitant of a very cold climate.

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* Here we have it distinctly shown, that, even within the tropics, the elephant is in his most natural climate, in the hottest parts; and if the constitution of the animal, in its wild state, cannot be fully sustained in regions of the most luxuriant vegetation, but subject to occasional slight frosts, how are we to suppose, for a moment, that elephants could have lived in the temperate or frozen regions of the earth?

"The rhinoceros is an animal whose natural history is very imperfectly known. He resides in impervious jungles and swamps; he is seldom to be found on the west of the Ganges, though the jungles there are fully competent to afford abundant shelter; nor, indeed, has an elephant ever been seen in a wild state, but to the east of that noble stream. It would seem that these animals are partial to the immense tracts of the *surput*, or *tassel grass*, which skirts the vast jungles bordering our possessions on that side; and which, being composed of lofty forests of saul and sissoo trees, filled up with various sorts of underwood, offer an asylum to the ferine species, such as cannot be equalled in any part of Europe, and can be compared only with the prodigious wilds of the American interior."

——The rhinoceros is never seen in herds, nor often even in pairs. He may, therefore, be properly termed, like the largest wild boars, and the oldest chamois, a *solitaire*.

We may now shortly pass under review the opinions of the late Baron Cuvier, on the subject of fossil remains. This able philosopher has long been considered the head of the scientific world on the continent; and his indefatigable research, and wonderful anatomical knowledge, have given him the highest claims to our esteem and regard in many branches of geological research. We have already found, however, that his theories of the earth, and of the numerous revolutions to which he supposed it had been subjected, were not founded on what history teaches, or physical facts bear witness to; and, therefore, we cannot be surprised, if we find, on the subject of fossil remains, some portion of that contradiction and inconsistency which must always attend a departure, however well meant and unintentional, from the direct and simple path of truth.

On the subject of the fossil elephant, as published in his "*Ossemens Fossiles*," vol. i. p. 199, &c. Cuvier designates it "The Mammoth of the Russians, (Elephas primigenius, Blum.) or elephant with prolonged cranium, concave forehead, very deep sockets for the tusks; lower jaw obtuse; grinders very large, parallel, and marked with narrow stripes.

"The bones of this animal are only found in a fossil state: they are in great numbers in many countries, *but better preserved in the north than elsewhere.* It resembled the Indian rather than the African species. It differed, however, from the former in the grinders, in the form of the lower jaw, and in many other bones, but especially in the length of the sockets for the tusks. This latter character must have modified, in a remarkable manner, the form and organization of the trunk, and have given him an appearance much more dissimilar to the Asiatic elephant, than could be expected from the general resemblance of the rest of the bones. It appears that his tusks were generally large, often *more or less* bent in a spiral form, and pointing outwards. His size was not much greater than that which the Asiatic race sometimes attains; and he appears to have had, in general, a more thick and solid form. We cannot determine what was the size of his ears, nor the colour of his skin, but it is certain, that *at least some of the species* had two sorts of hair; viz. a reddish wool, *coarse* and *bushy*, with stiff black hairs, which, upon the neck, and along the back, were pretty long, and formed a sort of mane.

"Thus, there is not only nothing impossible in his having been able to support a degree of cold, in which the Asiatic race would die; but it is even probable, that he was so constituted, as to prefer cold climates. His bones are usually found in the upper alluvial beds of the earth; and most commonly in those *which fill the hollows of valleys*, or which form the beds of rivers.

"They are scarcely ever alone, but pêlemêle, together with the bones of other quadrupeds of *known kinds*, as rhinoceros, ox, antelope, horse, and frequently with the remains of *marine animals*, such as shells, &c., some of which are even *fixed upon them.*

"The positive testimony of Pallas, of Fortis, and of others, *admits not of a doubt* with respect to this latter circumstance, although it is not invariable. I have now, myself, under my eye, a portion of a jaw, loaded with *millepores*, and with small *oysters.**

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*In the splendid collection of fossils of Dr. Buckland, at Oxford, there is a highly interesting specimen of one of the crocodile tribe, obtained from the quarry at Shotover, near that city, and several hundred feet above the level of the sea; on one of the bones of which there is a large *oyster* attached; and also two beautiful and

"The bones of elephants are rarely *petrified;* and we know of but one or two instances in which they are embedded in shell limestone or other rock."' (Such instances are as good as thousands, for the purpose of showing how they become thus embedded.)

"Every thing, then, announces, that the *cause* of their destruction was one of the most recent of *those events* which have contributed to change the surface of the globe. It was, however, a physical and general cause. That cause was an *aqueous* agent.

"But it was not these waters which transported them to the places where they now are. An *irruption of the sea,* which would only have brought them from where the Indian elephants now inhabit, could not have spread them to such a distance, nor dispersed them so equally."

It would appear from this remark of Cuvier, that he had no belief in the *general* and *total immersion* of the whole dry lands of the earth, at the period of the deluge; and he must, therefore, probably have considered the Mosaic account of "all the hills, upon the whole earth, being covered," as a mere piece of Eastern allegory. Such "*irruptions of the sea,*" as he had in view in the above remark, must have been considered as only *partial convulsions,* and producing such partial effects as he there alludes to. Had he believed in *a general aqueous covering* over the whole globe, for the space of *several months,* and had he then considered the *laws of nature,* acting, in this flood of waters, on the *floating* bodies of the animal world, by *tides* and CURRENTS, this able naturalist and philosopher could not but have perceived, that it was ONLY by such means, that so "*equal a dispersion*" of animal remains could possibly have been effected.

After some other equally unsatisfactory reasoning, Cuvier expresses his idea of the *impossibility* of *entire carcasses* having been transported to such distances by violence.

"It is true," says he, "that in such a case, the bones would have been *unworn by friction;* but then they would have remained together, and not been found so scattered as they now often are.

"Every thing then renders it *extremely probable,* that the elephants to which these fossil bones belonged, *inhabited the*

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perfect specimens of the *ammonite,* with the shell entire, and seemingly fixed to the bone by suction, as a snail adheres to a stone or plant.

countries where we now find their remains. They were there scattered, as the bones of horses and of other animals now are, over our own lands, the carcasses of which are found in our fields."*

"But, whatever that cause was, *it must have been a* SUDDEN ONE. The bones, so perfectly preserved in the plains of Siberia, could only have been so from the effect of *cold*. If this cold had only come on by *degrees and slowly*, the bones, and especially the softer parts, would have had time *to become decomposed, like those we now find in our fields*."

The remark cannot here be omitted, how contradictory is the reasoning of the baron in this place. He first considers, that the bones of the animals must have been scattered over the country, like those of our domestic cattle, in the present day; and ought to have been "decomposed, like those we now find in our fields;" and then proceeds to show, that they are *not decomposed*, but preserved entire by a sudden convulsion, and excessive low temperature. We seldom find, in our own times, and in our *inland counties*, the bones of cattle covered with OYSTERS, or other sea animals. But if we suppose a bone, or an entire animal, to remain for a few weeks, subject to the action of the tides and of the currents, we should not be surprised at finding upon it, what every piece of floating wreck is generally covered with.

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* I have been informed by Colonel Sykes, than whom we can have no higher authority on such a subject, from his long residence in the East, and the great attention and ability which he has displayed on every subject connected with science, that, as far as his observation goes, it may be looked upon as a striking and extraordinary fact, that in the forests of India, peopled as they are by thousands of animals of every size, and of which there must naturally be a considerable annual destruction as well as increase, the bones, or other remains of the dead, are scarcely ever to be seen. We cannot, indeed, wonder that this should be the case, when we consider the laws of nature, by which so just a balance is at all times kept up. In so hot a climate as that of the tropics, the decay of the softer parts must be most rapid; and in order to obviate the bad consequences which would attend this natural course, we find myriads of the insect tribe at all times ready to remove what the birds and beasts of prey cannot readily consume. A large animal body, therefore, would almost entirely disappear in the course of a few days; and even the *bones* must soon become decomposed under the powerful action of so hot an atmosphere. It is almost proverbial even in our own woods, well stocked as they are with hares and other game, how seldom we discover any indication of natural death. In the animal world, in every climate, each individual becomes the prey of his fellow, for "dust we are, and unto dust we soon return."

"It would have been especially impossible for the carcase seen and described by Mr. Adams, to have preserved its *flesh and its skin* ENTIRE, *if it had not been* IMMEDIATELY *enveloped in the* ICE in which it was found." We must here pause one moment in our perusal of Cuvier's argument, to consider what effect would have been produced by this SUDDEN *formation of an icy bed*, on the *woods and jungles* through which this shaggy monster must naturally have been wandering, when embraced and sealed up by so SUDDEN a disaster. The same element which had so *preservative* an effect upon his unwieldy carcase, must have entirely decomposed or evaporated the *vegetable productions* on which he fed; as they are no whère to be found in any part of the frozen regions, even preserved in ice.

"Thus," continues he, "the hypothesis of a *gradual* cooling of the globe, or of a *slow* variation of its temperature, either from *inclination*, or from the *position of its axis, falls to the ground by its own weight.*"

We may here remark, that this groundless hypothesis was proposed by Buffon, as we have already had occasion to notice.

"The various mastodons, hippopotami, rhinoceri, &c., must have inhabited the same countries and the same districts, as the fossil elephants, since we find their bones in the *same situations, and in the same condition.* One cannot imagine any cause which would have destroyed *the one* and spared the *other.* And yet the first, most certainly, no longer exist, as we shall show in subsequent chapters."

"The elephant is the existing animal which most resembles the mastodon; and may serve as the principle object of comparison. In short, I call mastodon, quadrupeds of the size and form of the elephant, having, like him, a trunk, and long tusks; the feet of the same structure; and, in a word, only differing in an essential manner in the molar teeth, which, instead of being formed of transversal laminæ, had a simple crown, and were furnished with tubercles or rounded points, more or less numerous, and more or less prominent.

"Our continents do not now nourish any animals of this exact kind; although the upper strata contain the bones of three or four different varieties."—*Ossemens Fossiles,* vol. i. chap. ii. p. 205.

Such are the ideas of Baron Cuvier on the subject of the fossil elephant: and as it may be truly said, that the whole question of fossil remains, and, consequently, many of the most important and fundamental points in geology in general, turn upon the true and consistent history of those elephants now found in northern latitudes, it cannot be considered irrelevant to our purpose, to have gone, at considerable length, into the opinions of some of the great leaders of science on so fundamental a subject. To all who have considered, with an unprejudiced mind, the course and tendency of the arguments which have been urged, in opposition to these generally received theories on the subject of tropical productions in polar regions, it must appear unnecessary, in this place, to proceed further with the subject. It has been clearly shown, that no elephant could possibly find subsistence in those inclement and barren regions *at the present time.* It is equally clear, that had a SUDDEN change of temperature, with an irruption of the sea, overwhelmed and frozen up the animal productions of the antediluvian world, in what are now the polar regions, we must equally have discovered, in the ice which has preserved them, a perfect and entire series of the vegetable productions, amongst which, it is admitted, *they must have lived*, and *without* which there is no conceivable way of accounting for the supply of food necessary for such vast numbers of gigantic animals. When we add to this incontrovertible point, the consistent and natural method by which those animal bodies *might have been transported*, by an agent in the common laws of nature, to which the waters of the earth have been subjected by the Creator, for a great and benificent purpose, we cannot retain a doubt as to the *actual means* by which those larger animals were conveyed to their icy beds in the polar regions; and having arrived at this conclusion, with respect to those now found within the arctic circle, we have every right to judge, by the same line of reasoning, concerning all other tropical productions in *unnatural* climates, on every part of the surface of the earth; and, consequently, that the globe has undergone no material change in its position, nor in its temperature, since the creation.

Our inquiries have, it is to be hoped, led us to a consistent and natural conclusion on the whole question of fossil remains; and we thus find, that in adopting the system of geology, grounded on the Inspired History, and so strongly supported by the evidence of physical facts, instead of those philosophical theories, *founded on physical facts*, but *rejecting* the evidence of Scripture; the current of the narrative runs smoothly along, and our minds feel satisfied, and at rest, instead of being constantly suspended in doubt and uncertainty.

If we come to the conclusion, that all the present dry lands of the earth were formerly the bed of the antediluvian sea, and that Britain was no exception to this, (as is evident from the appearances every where visible around us,) it must follow as a corollary, that all the fossil remains of quadrupeds, whether in our upper soils, or in the upper strata of rock, over the whole earth, must have been lodged in their present situations by the waters of that destructive deluge, of which we have now been treating.*

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* Since writing the above, one of the most remarkable works of our times has appeared, in which we find the following passage :—

" It appears, from the marine shells found on the tops of the highest mountains, and in almost every part of the globe, that immense continents have been elevated above the ocean, which must have ingulfed others.

"Such a catastrophe would be occasioned by a variation in the position of the axis of rotation on the surface of the earth; for the seas would leave some portions of the globe, and would overwhelm others. But theory proves, that neither nutation, precession, nor any of the disturbing forces which affect the system, have the smallest influence on the axis of rotation, which maintains a permanent position on the surface, if the earth be not disturbed in its rotation by some foreign cause, as the collision of a comet, which may have happened in the immensity of time." The able authoress then proceeds to show how little influence the sea would have, even in such a case, upon the general equilibrium; and concludes thus,—" It thus appears, that a great change in the position of the axis is incompatible with the law of equilibrium; therefore, the geological phenomena (of fossils) must be ascribed to an *internal cause*. Thus, amidst the mighty revolutions which have swept innumerable races of organized beings from the earth, which have elevated plains, and buried mountains in the ocean, the rotation of the earth, and the position of the axis on its surface, have undergone but slight variations."—*Mechanism of the Heavens, by Mrs. Somerville.*

Upon the above passage, the Quarterly Review has remarked, that "the lunar theory teaches us, that the internal strata, as well as the external outline of our globe, are elliptical; their centres being coincident, and their axis identical with that of the surface; a state of things incompatible with any subsequent accommodation of the surface, to a new and different state of rotation from that which determined the original distribution of the component matter."—*Quarterly Review*, No. XCIV. p. 552.

Although I cannot subscribe to the doctrine which dictated the latter part of the above remark, nor to the idea of Mrs. Somerville, that the collision of a comet "may have happened in the immensity of time," although, we thus have acknowledged proof against the probability of any such collision, which is, therefore, quite uncalled for; we must hail, with pleasure, the step that has thus been gained by the admission of so able an authority. The theory of a change in the axis of the earth, which was only engendered for the purpose of accounting for tropical productions, in polar latitudes, is, therefore, for ever destroyed; and we thus arrive at the same point by various different roads.

After this concession, that the phénomena of geology must have originated in a cause *not external* to our earth, we may hope, that the true internal cause will, ere long, be equally admitted. One other such departure from the usual theories of the deluge and the union which is every day approaching, between Philosophy and Scripture, will be at length completed.

SUPPLEMENTARY PART TO CHAPTER XI.

Since entering upon the subject of the Geology of Scripture, the evidences in support of the general principles, which have been explained in the foregoing chapters, have so crowded upon my observation, that I have experienced some difficulty in confining myself within those limits which I had previously laid down, in order to bring my work within the compass of one single volume. In a late journey which I have had occasion to make throughout a great part of the longitudinal extent of the kingdom, I have found, in every direction, the most complete corroborative proofs of the solid foundation on which the Scripture system is constructed. Amongst many of these proofs, I cannot resist the present opportunity, of giving some short account of a few of the most remarkable; the particular importance of which must at once be acknowledged by every candid student in this interesting science. I allude particularly to the subject of *entire fossil trees*, frequently, of late, discovered in the coal strata; and to that of the foot-marks of animals distinctly imprinted upon the sand when in a soft state, and discovered on the upper surface of the strata in several free-stone quarries.

The instances of entire fossil stems of trees, and numerous smaller plants, have long been remarked in the coal formations in various countries; and have, also, been noticed in the former part of this work. But the stems of the larger plants have, hitherto, in general, been observed to lie in the same direction as the strata themselves; and, consequently, they could afford us little or no indication of the period at which they were embedded, or of the time necessary for their having become surrounded by their present mineral envelope. Late observations, however, have thrown a new and vivid light upon this hitherto obscure subject. Trees, of very considerable size, have been found, placed in a position perpendicular to the direction of the beds or strata, and intersecting many of these, of various kinds and thickness. One of the first that attracted particular notice in the North, was found in Craigleith free-stone quarry, in 1826, where the different visible strata exist to the extent of 160 feet in depth; and upwards of 60 feet more are known to lie below, which have not yet seen the light of day.

The stone in this immense quarry is of very white and pure-grained quality, and is the same which we find forming the roof of the coal beds in many of the Lothian collieries. It is every where, more or less, marked with impressions of leaves and stems, which are, in this case, however, far from the coal seams, but the latter of which invariably present a thin surrounding mass of the purest jewel coal, generally about a quarter of an inch round the bark; the whole of the rest of the interior being filled with the same mineral in which it is embedded. These fossil stems are called, by the miners, *coal pipes*, ignorant as they are of their real nature. This small portion of the purest coal, serves to give us considerable insight into the nature of the larger beds of this fossil production, which are evidently the consequence of great pressure, and some chemical process, connected with the nature of the wood itself, with which, however, we have, as yet, no acquaintance. In 1830, a second and more remarkable fossil tree was exposed to view in this quarry; and excited, from its particular position, a degree of interest which no other vegetable fossil could before lay claim to. Its total length was upwards of 60 feet; and at an angle of about 40 degrees it intersected 10 or 12 different strata of the sand-stone. Its diameter at the top was about seven inches; and it had become flattened by pressure near its base, in such a manner as to measure *five feet*, in its greater, and *two feet* in its lesser diameter. There were no branches, nor marks of them on its bark; nor were there any roots, although the lower part formed a species of bulb. As in the former specimen, the bark had been converted into a thin coat of the *purest* and *finest coal;* and the whole, as it lay exposed in the quarry, presented the appearance of charred wood, forming a striking contrast in colour with the white stone in which it lay.

Before making any remarks upon the important evidence depending on this fossil, I shall describe some other instances, which have come within my knowledge, of trees standing in an upright or slightly sloping position, and intersecting a great variety of strata.

In a colliery, near Dalkeith, which I lately inspected, I found a stem of nearly two feet in diameter, proceeding *out of the floor* of the coal seam, *passing through the coal* itself, and *entering the roof* above. In the floor, and in the roof, it was *petrified*, whilst, in passing through the coal stratum, *it had become one mass of pure coal*, and its shape was with difficulty distinguished. How far its top or roots extended could not be ascertained; but it is probable that it was of much greater length than met the eye.

In Cullelo sand-stone quarry, near Aberdour, in Fife, numbers of trees are found, supposed to be of the palm-tribe, and often intersecting the strata in the rock.

In Killingworth colliery, north of Newcastle, there are many large fossil trees discovered in the coal strata, and they frequently have some indication of roots. One of these is particularly described and figured by Mr. Wood, in the Transactions of the Natural History Society of Northumberland. Its roots rested in the shale, immediately above the coal bed, and its stem pierced 10 or 12 different strata.

In Wideopen free-stone quarry, near the house at Gosforth, in Northumberland, a tree, of 70 feet in length, and lying across the strata, was lately discovered in a petrified state.

In Jarrow colliery, also, similar plants are found in considerable abundance; and in the Gosforth pit, down which I lately went, (a depth of 190 fathoms in one shaft, being the deepest now in the kingdom,) I found the roof of the main coal stratum to be entirely composed, in many places, of trunks of trees, lying in every direction, and of very considerable size.*

From all these instances, (and many others might be quoted if it were necessary,) we cannot but perceive, that our previous notions of the formation of strata in general, have been of the most erroneous description; for when we look at a lofty cliff of sand-stone rock, without any embedded fossil, we at once conceive to ourselves *the vast length of time* which we had been taught, by geology, to assign, for so extensive and gradual a formation. But such an example as the Craigleith fossil tree exhibits, must serve at once to show, that instead of *thousands or millions of years*, for such deposits of sand-stone rock, but a very short time indeed must have been occupied in the formation of the whole of this quarry; and, consequently, of the whole coal formation which rests below it. The tree could not possibly have remained in a reclining posture, if only held by a few of the strata near its base. Nor could it have been long exposed with its top protruding in air or in water; a few passing waves, or, at most, a few days of the agitated and turbid waters of the deluge, must have been sufficient for the formation of the whole bed in which it is now found, and which we are apt to look upon as of vast extent. In the same manner we are instructed by those fossil stems, which pass through a coal bed from the floor, into the strata above, to a great height. These are only further indications and proofs of the truth of what I have before stated, that the formation of coal, under every circumstance, must be attributed to the progressive sinking and covering up of the diluvial vegetable ruin at the period of the flood; and that this invaluable fossil production, in its present state, has been the result of prodigious *pressure* on the one hand, and of *chemical action* on the other.

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* I cannot here omit remarking, that in Jarrow colliery, the muscle beds or strata, containing sea shells, are very abundant. I saw some specimens of these shells in the museum at Newcastle; they exactly resemble those muscles found in the blue clay, reposing on the chalk at Pegwell, in Kent.

I also find, that in some of the coal pits in Scotland, (and that of the Drum, near Dalkeith, was particularly mentioned,) sea shells, as large as oysters, are frequently found in the roof of the coal stratum, as if they had been stuck into clay from below.

We cannot, for a moment, doubt that all the beds through which these stems now pass, were once in a soft or semi-fluid state, like the sands upon the sea shore, about the ebbing of the tide. The whole strata, however horizontal they must once have been, have since become more or less deranged, *not by elevation*, but by *depression;* and upon this principle alone I have already explained the origin and cause of the *slips*, *dykes*, and *troubles*, so well known in all mining countries. We now account, in a natural and consistent manner, for a large proportion of all the upper soils and strata with which the surface of the present earth is covered. Let us only suppose, for a moment, a greater number of these fossil stems acting, as they do, as *measures*, cast into various parts of the diluvial strata, one above another. If a series of twelve or fourteen solid beds of sand-stone, and other strata of the coal formation, were formed in the short space of time necessary to support *one tree of sixty or seventy feet long, in a reclining posture*, we have a full right to carry our ideas much further on the same scale. Our notions of *lacustrine quiet deposits*, in an immense *period of years*, must be for ever laid aside with regard to the coal fields. The presence of sea shells, in even a few of the coal strata, is sufficient for the total destruction of this long received theory. And if we are forced to give up this *proof of the great antiquity of the globe*, we must naturally enter upon that more consistent and well defined system presented to our contemplation in the geology of Scripture. We thus attain, by these *vegetable evidences*, the same strong ground we had already taken up, by the testimony of *animal fossil bodies*, on every part of the earth's surface. Every thing is consistent and agreeable to history, instead of being contradictory in all its parts, and directly opposed to what the Sacred Narrative so plainly lays before us.

I feel it scarcely necessary here to remark upon the singular notion entertained, by some, of these fossil trees having *grown* in the sandy or argillaceous strata in which they now happen to lie. This mistake arises, like most of the other erroneous notions in geology, in the constant idea that we are now living upon the antediluvian dry lands; an idea which we have already found it necessary entirely to lay aside. Had the trees grown where we now find them, their roots must have been fixed on a different material from that which now covers the stems; and we must have discovered, which has never yet been done, some indication of a former soil, suited to the nourishment of so rich a vegetation.*

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* In a lately published work of Mr. Lyell, to which allusion has, more than once, been made, and in which that able writer takes a very luminous view of the secondary causes in constant action on the surface of the earth, we find a very striking (though altogether unintentional) argument against the generally received theory, of the fossil remains of tropical quadrupeds now found in our upper soils and strata having belonged to animals formerly naturalized to our climates, and inhabiting our "antediluvian forests." This argument is found in his account of the formation and extent of peat mosses in the North of Europe, in the course of which, this author clearly shows, "that a considerable portion of the European peat bogs are evidently not more ancient than the age of Julius Cæsar;"* an admission we could scarcely have looked for, from a writer,

* Principles of Geology, vol. ii. p. 214.

With regard to the fine fossil tree, we can have no sort of doubt of its having been embedded, together with all the other vegetable matter found in the quarry of Craigleith, in the course of a few days, or, perhaps, of a few *tides;* a con-

whose whole theory is founded on "the economy of Nature," having been "uniform," and the laws, which direct the changes on the earth, having "remained invariably the same:" for, as a great part of his work is occupied in endeavouring to show that the present system of Nature has been regular, and has proceeded in the same course for millions of years, we can in no way account, in a system of such indefinite extent, for the origin and growth of peat, within so comparatively trifling an era as the days of the Romans.

"The antlers," says he, "of large and full grown stags, are amongst the most common and conspicuous remains of animals in peat. Bones of the ox, hog, horse, sheep, and other herbivorous animals, also, occur; and in Ireland, and the Isle of Man, skeletons of a gigantic elk; but no remains have been met with belonging to those extinct quadrupeds, of which the living congeners inhabit warmer latitudes, such as the elephant, rhinoceros, hippopotamus, hyæna, and tiger, though these are so common in superficial deposits of silt, mud, sand, or stalactite, in various localities throughout Great Britain."—Vol. ii. p. 218.

Now, it must be evident to every one, that if England, and the rest of Europe, where peat is now found in such abundance, (and containing the remains of animals preserved in the complete manner peculiar to this substance,) were formerly in existence above the waters, and were covered with forests and wilds, suited to the shelter and nourishment of elephants, and other large quadrupeds, now confined to the tropics, there can be no conceivable reason why peat should not have been, as it now is, in constant progress; nor is it consistent with analogy and facts, that such animals as are said to have been so abundant in these supposed forests, should not occasionally have been found in such situations. In this dilemma we naturally look for the means by which so great an inconsistency is accounted for by its author, who, accordingly, proceeds as follows: "Their absence seems to imply, that they had *ceased to live* before the atmosphere of this part of the world acquired *that cold and humid character which favours the growth of peat.*" Why they "ceased to live," we have no reason given, nor can we conceive any reason that would agree with the rest of Mr. Lyell's theory. Their disappearance could not have arisen from cold, because we are told by this author, in another part of his work, when treating of the fossils of the polar regions, that the greater part of the elephants lived in Siberia, after it had become subject *to intense cold,* which is confirmed, amongst other reasons, by the state of the ivory," &c.* This "intense cold" could not have existed in Siberia, when inhabited by elephants, without its influence being also extended, as in our

* Principles of Geology, vol. i. p. 3.

jecture for which we shall presently find that there are the strongest possible grounds. And as this free-stone formation, *of at least* 220 *feet* in depth, is of precisely the same nature as that which forms the roof of many of the coal beds in that neighbourhood, and containing the very same fossil vegetable productions, we come at once to the strongest evidence, both as to the *nature* and the *period* of the whole contents of the coal basins; and, also, of the very great rapidity with which they must have been deposited.

All these facts tend, in the strongest manner, to confirm the opinions I have before, and at greater length, expressed; that the coal beds were formed at the period of the deluge,

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own times, over Russia, Germany, Sweden, and England; and consequently, these countries must have, even then, enjoyed precisely "that cold and humid character which favours the growth of peat."

"Some naturalists," says Cuvier, "reckon much on the thousands of ages which they accumulate with a dash of their pen; but, in such matters, we cannot venture to judge of what might be produced in a long time, except by multiplying, in idea, what a shorter period does produce."

We have never yet had any geological account of the extensive peat mosses which ought to have existed in the "antediluvian forests of Yorkshire," and in the rest of Europe; nor can we readily believe that elephants and rhinoceri, could have inhabited such forests, or passed over such swamps, without having been occasionally buried in the peat, and preserved in the same manner as cattle are in our own times.

There can, perhaps, be no stronger ground taken up for the support of the Geology of Scripture, or for the destruction of the theory of indefinite periods, than the argument arising from the nature and extent of peat moss; and, by doubling the short period, admitted by Mr. Lyell, or, obtaining from his abundance, so trifling a boon as a couple of thousand years more than he has already freely given us, we can perfectly account for its comparatively recent formation, as well as for the total absence of tropical animals and plants. Peat is, as Mr. Lyell has well explained, a recent formation, in constant progress in certain favourable situations and circumstances. It is, in short, of post-diluvian growth, and contains only such animal or vegetable remains as are natural to our European climates. The beds of "silt, mud, sand, and stalactite," in which tropical organic remains are mixed up with those of temperate latitudes, are equally superficial; but they owe their formation to a different period, and to a different cause. They are diluvial formations; and as they owe their origin to that destructive period, we cannot wonder that they should contain proofs of the indiscriminate organic ruin, which naturally resulted from that preternatural judgment.

by successive deposits of great vegetable masses, which must have been matted together, and floating on the waters at that eventful time; and that the contents of all the *basins* of geologists, whether containing coal, or not, must have also become deposited at the same period; the whole of these moist formations being stratified according to the common laws in constant action in the ocean; and, on the depression of the waters into their new bed, becoming, in many places, deranged by *depression*, and, subsequently, hardened into the stony masses now exhibited to our admiring view.

I now come to the second subject on which I proposed making a few observations in this place; and which presents perhaps, one of the most difficult problems in the whole extent of our geological inquiries.

I allude to the *fossil foot-marks*, if I may so call them, of animals, which have, in a few instances, been distinctly discovered on the surface of the strata, in sand-stone quarries. I am not aware of more than two known instances of this remarkable fact. The first occurred in a red sand-stone on Corncockle muir, in Dumfrieshire; and the second, in the same free-stone quarry of Craiglieth, where the large fossil tree was discovered in 1830. I do not happen to have read or heard, what are the opinions of philosophers on this remarkable subject; but I cannot help thinking, that the evidences to be found in Craigleith quarry, with respect to the above-mentioned fossil trees, will serve as a ground for the most probable conjecture with respect to the true nature of those animal foot-marks on the diluvial sands.

These impressions, of which some of the originals, as well as casts in stucco, are to be found in various collections, indicate a small animal, having a foot about the size of that of a fox. There appears to be considerable variety in the size, but as to the identity of conformation in every case, I have not yet had an opportunity of correctly ascertaining the facts. Trials have been made, by making a variety of animals walk over sand, or moist clay; and I have been informed, that it was the opinion of Sir Everard Home, that the impression of the track of the tortoise was the nearest to those hitherto found in the quarries.

As I am entirely ignorant of the locality of Corncockle Muir, I shall confine myself to those impressions found in the Craigleith free-stone, and of which casts have been placed in the Museum of the Royal Society of Edinburgh.

In endeavouring to solve this geological mystery, we must bear in mind two positive facts, with which we are made acquainted by the evidence of the fossil trees above described: first, that the whole formation of the rock, in which both are found, must have been *very rapid;* and, secondly, that there is no conceivable means, within the common laws of nature, with which we are acquainted, by which such rapid formation could take place at the present time.

In the course of the view I have formerly taken of the action of the deluge, and its effects upon the "*earth that now is*," I had an opportunity of explaining what the appearances must probably have been, both on the rise and on the decline of the destructive waters. I have shown, that as the position of the globe, during this awful judgment, remained precisely the same as it was before, and as it ever since has been, the effects of the sun, and of the moon, as exhibited in the *tides*, must have remained in equal, if not in greater force, than at other times. This action of the tides must have been particularly powerful on the gradual decline of the diluvial waters, at a time when the new lands, in a *soft state*, began first to appear above the surface; and, in process of time, to be, for a short space, periodically left dry by the ebbing tide, in the same manner as the sandy or muddy shoals on our own, or on the Dutch coast.

Now, in the present course of things upon the earth, the footsteps of any animal, passing over the smooth sands on the ebb tide, could not long resist even the gentlest action of the waves, because the waters of the ocean, in their natural state, are so nearly pure, and free from sediment, that the progress of secondary formations is so slow as to be almost imperceptible to our view. But, at the awful period of which we are now treating, the case must have been totally different. The waters of the whole sea must then have been, as we have before shown, heavily charged with their preternatural burden; and every successive tide must, consequently, have deposited some additional beds upon the growing earth. In this manner alone can we account for the rapid deposition of the trees we have just been considering; and, in this same manner alone can we also account for the preservation of those animal foot-marks now discovered between the strata.

But it will naturally be asked, where was the animal to come from, at a time when the whole living kingdom was in the act of being destroyed; or, (if the foot-marks were made, as appears most probable, on the *decline* of the deluge,) when all had already perished? To this we reply, that we have here the most positive evidence, that *all* had not yet perished when these sandy formations were being so rapidly deposited. At whatever period of the deluge this deposit took place, we see, that at least a few individuals, of the animal world, were lingering out a miserable existence, perhaps preserved for weeks or months upon these same vegetable islands which we have seen were being deposited in the immediate neighbourhood, and now exhibited in the form of coal. If the animals in question were of the tortoise or turtle tribe, as has been generally conjectured, and, consequently, of an amphibious nature, we can have the less difficulty in finding a solution for this interesting problem; for, in considering the fossil remains of the natural inhabitants of the sea, we have before found it probable, that by no means a general destruction took place amongst this extensive class at the period of the deluge.

The impressions I have had an opportunity of seeing are of various degrees of freshness; but none of them have the appearance of a longer time than would occur between one ebb tide, and the following flow. If an animal pass along a fresh sand bed, on the present shores, the impression of his steps soon becomes less sharp, as the moisture is evaporated from the drying sands.

These *fossil* foot-marks have all the appearances exhibited on a recent *sand bank*. They, in some instances, indicate a short and shuffling gait, with the feet pressing *outwards*, and are such as we can suppose an amphibious animal to produce. Had the marks occurred in *clay*, instead of in *sand*, we can suppose the air to have completely *hardened* the impression, so as to have preserved it a long time before being covered up. But such is not the case; and we can, therefore, have no manner of doubt that they were occasioned by some animal coming *ashore on a sand bank left dry by the tide;* and that the returning waters, heavily charged as they must have been, with diluvial sediments, immediately covered up the former strata, and thus preserved entire those most interesting and solitary indications of a still living antediluvian race.

We find in this same quarry of Craigleith, another remarkable evidence of the truth of what has now been stated. For it has been remarked, by the intelligent individual who has the management of these valuable works, that, on the upper surface of the whole quarry, wherever it has been covered up, and protected by the mixed diluvial soils and rounded stones, now so general on the surface of the earth, the upper stratum is marked with *grooves* or *scratches, generally lying in a S. W. direction*, and, evidently, attributable to the impression of gravelly substances hurried along by the currents, about the termination of the flood. Similar grooves have long since been remarked, especially by the late Sir James Hall, whose active and intelligent mind has suggested so many original and acute remarks on the phenomena of nature, as well as in the wide field of scientific research. As we have already found that the action of currents is at all times most powerful in the ocean, and must have occasioned many wonderful effects at the period now in question, we cannot be surprised, on the discovery of such self-evident proofs; nor can we avoid being struck with admiration at the consistent and remarkable manner in which all these evidences concur towards the same points, exhibited in the Inspired History. It is to this eventful period, and to it alone, that we must also look for a solution of the great question with respect to the valleys of the earth's surface, about which so many remarkable theories have been, from time to time, brought forth. We can now plainly perceive what, in these philosophical *theories*, has never been made clear to the intelligence, that the rounded forms of our hills, and the easy rotundity of our secondary slopes, must all have been occasioned by the action of the retiring waters upon the soft and recent deposits. We now plainly perceive why our mountain lowland valleys are much longer and more extensive than the action of their *running streams* could possibly have occasioned, even in MILLIONS *of years.*

We now also find a natural and consistent reason for many deep sections of sandy and calcareous rocks by rapid streams, on every part of the earth's surface. We find the strata of one side so exactly corresponding with those of the other, that no doubt can exist as to their once having formed one united deposit, through which we have, hitherto, supposed the rivers must have taken *unlimited periods*, to work their deepened beds. We cannot now wonder if we found a difficulty in making these phenomena correspond with the existing laws of nature; for they differ in a manner so material from every thing now observed in action in the world, that no *human* ingenuity could possibly clear up the difficulty. Nothing short of that Divine Inspiration in the Sacred Scripture-

History, which has been vouchsafed to us, for the most beneficient ends, could ever have enlightened our benighted minds, which, in rejecting this powerful evidence, have hitherto wandered in a maze of inextricable obscurity. Let it not be urged for the future, as has hitherto so often been done in our philosophical schools, that Scripture was graciously bestowed upon us only for *moral*, and not for *scientific* purposes. If we make a humble and proper use of the indications on many philosophical inquiries, which are presented to us in the Inspired Writings, however slight they may appear, we cannot but confess, that every word of Scripture "has been written for our learning," and that no part of it has, consequently, been given us *in vain*.

From the indications derived from this inspired source alone, could we have attained the conclusions to which the above phenomena consistently lead us:—

First, that coal is an undoubted vegetable production.

Secondly, That it became embedded at a much more recent period, and in a much more rapid manner, than we have hitherto thought.

Thirdly, That it was an *aqueous* deposit.

Fourthly, That that *aqueous medium* was MARINE, and not LACUSTRINE; and,

Fifthly, That one or more beds, in many secondary strata, were formed with intervening ebb tides on the decline of the diluvial waters; and, consequently, that the theories of geology, which advocate *unlimited periods* for the age of the earth, are not only contrary to our reason, but entirely opposed to those leading beacons which Scripture holds out for our guidance and instruction.

CHAPTER XII.

Elephants clothed with Hair and Wool.—Existing Instances of this Variety, even within the Tropics.—Probable Identity between the Mammoth and the Asiatic Elephant.—Cuvier's Theory on this Subject inconsistent with Facts.—More Natural Conclusions.—Erroneous Theories respecting Fossils.—The Mastodon not confined to the Continents of America, as commonly supposed.—Instance of the great Mastodon in England.—Form of the Tusks of the Mastodon.—Erroneous Ideas on this subject.

Having now tried upon its own merits this interesting and important question, respecting the former history of the earth, by the presumptive evidence derived from the northern fossil remains; and having, by conclusive, though *indirect* proofs, shown that the elephants, found in the ice of the Arctic regions, never could have been *inhabitants* of such high latitudes, but must, on the contrary, have *all* been drifted to their present beds by the natural currents, which have, at all times, prevailed in the ocean; and that these natives of tropical climates never could have existed but in the latitudes in which we now find them naturalized, notwithstanding the startling fact of some individuals having been found *entire*, and covered with a warm coat of *hair* and *wool;* I now proceed to bring forward, what may truly be considered a positive and *direct* evidence of the correctness of those conclusions to which we have been led. For, as many of the theories of geology may be distinctly traced to the remarkable fossil animals, covered with a shaggy coat, which have already been so fully described, it is a point of the very highest interest and importance to geology, to find that the arguments, grounded on this hairy covering, can no longer be of the smallest service in the support of such false and contradictory opinions. For it has, within a few years, been indisputably proved, that though neither the common Asiatic, nor the African elephant, requires, in general, such natural protection, owing to the heat of the climates which they most delight in; yet that a variety of the species *actually exists* in one district of Hindostan, in the immediate neighbourhood of the Hymalaya range, *having a thick and shaggy coat of hair;* and being thus suited, by the common laws of nature, to become the inhabitants of a region *comparatively cold.*

When we consider the admirable manner in which animal as well as vegetable productions accommodate themselves to the particular temperature in which they are placed, we cannot feel surprised, that, in some instances, elephants *with hair*, should be found to exist. For the common Asiatic elephant cannot be regarded with any attention, without our perceiving that, on almost every part of his bare hide, there is an indication of hair, such as we see on some species of the dog from Turkey, or of the hog from China;* and we may, therefore, safely conclude that, as in both these familiar instances, the clothing, natural to most other animals, is only wanting in the case of the elephant, from the warmth of the climates to which he is, for the most part, confined. This natural clothing, however, which circumstances alone have, in general, caused him to lay aside, is immediately called into action, when a cooler temperature requires its presence. An elephant does not continue long in our temperate climates without this provision being more or less developed; and we have, at this moment, in London, most decided instances of this incipient roughness, in the two elephants belonging to the Zoological Society in the Regent's Park.

The *recent* discovery of this zoological fact, in a country which has so long been occupied by numbers of our countrymen, may, perhaps, be looked upon as one of the most remarkable parts of it; and though the work I am about to quote has now been for several years before the public, I do not any where find that this new and interesting variety of the elephant has met with that attention to which it may certainly lay claim. That it bears in a most remarkable manner, on the great questions in geology, must be apparent to all who have attended to the line of reasoning so recently explained. For it must be evident, that if the common elephants, of the hottest climates, *without hair*, were floated by the currents from a tropical to a frozen region, and were there *stranded*, and *sealed up*, on the subsiding of the waters; all such as inhabited a *cooler* climate, *even within the tropics*, must also have been subjected to a similar mechanical power. But we are not to suppose, because a few fossil specimens may have been found with hair, that *all* the elephants, whose remains are embedded in the northern or temperate climates of the earth, were of this rough species. On the contrary, it may safely be looked upon as certain, that the number of bodies *with hair*, bore no greater proportion to those *without*, than we now find to exist in the living species. We have every reason to conclude, that the elephant is a native only of such climates as furnish, in luxuriance, the vegetable productions on which he feeds. They are no where found, in a natural state, in temperate latitudes; but only in those countries where the herbage may be termed *gigantic*, and where the jungles are so thick, that the animals may not only be completely concealed from their enemies, but may also find an easy and abundant subsistence. Such is the case, not only in the low and swampy plains of Hindostan, but, also, in the districts of India, bordering on the mountains, where a higher elevation in the atmosphere counteracts, in some degree, the powerful effects of the sun, and occasions a temperature, which, in India, is termed *cold*, though the thermometer may rarely indicate the freezing point.

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* It is well known, that many of the hog tribe, especially those from China, have little or no hair, when first brought into our climates. The laws of nature soon, however, take effect; and they not only, in the end, become covered with hair, but they also acquire a complete under-covering of wool, as is well known to all fly-fishers.

The first, and, as yet, only notice we have of this shaggy variety of the elephant, is to be found in the interesting journal of Bishop Heber. It was in the course of that long tour round the district over which his spiritual government extended, that the bishop arrived in the residency of Bariellу, a city situated in the plain, in the 28th degree of north latitude, and about 50 miles from the lower range of the Hymalaya. It was at only one day's journey from Barielly, on his way to the mountains, and while passing through the unwholesome forests and jungles of the plain, that he was visited by a native border prince of that district, who invited him to join in the hunting of a tiger, which had lately been seen in that neighbourhood. It is in the short and animated description of this hunt, that the bishop makes use of the following terms: "The rajah was mounted on a little female elephant, hardly bigger than the Durham ox, and *almost as shaggy as a poodle.* She was a native of the neighbouring woods, where they are generally, though not always, of a smaller size than those of Bengal and Chittagong."

Heber again mentions having met the same rajah, a few days afterwards, "on his little elephant;" and we cannot peruse this concise, yet particular description of so casual a circumstance, without perceiving, that, though he does not enter into details upon the subject of this rough-coated elephant, yet his attention was, on both these occasions, particularly attracted to so uncommon an animal. I am the more desirous of drawing the attention to the artless and familiar description contained in the above passage, from having found, on inquiry from many who have spent a great part of their lives in the East, that this variety of the elephant is so little known, that much doubt is entertained, by some, as to the correctness of the account of it.

Setting aside, however, for a moment, the character of the individual from whom alone we have, as yet, derived our information of this new living variety, let us consider the collateral circumstances of the case; and we shall find, that this generally, though not invariably *small* race of elephants, are said to be the natural and wild inhabitants of an extensive range of jungle, where, *though ice is rarely seen*, yet *hoar frost* is quite a common occurrence; and where, consequently, the clothing of the native animals might be expected to be warmer than in the burning plains, at a greater distance from the highest mountains on the globe.

We find, that this very animal on which the rajah was mounted, accompanied the bishop to the town or village, where he was to leave his elephants for a time, and to continue his journey on "little white shaggy ponies," in every respect similar to those of Wales, or of Scotland, to which Heber likens them; and in the course of one day's journey further, he begins to mention *chamois*, which are well known to be naturalized only in very cold climates.*

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* "The pahariahs, or hill people, are quite a distinct race from the rest of the inhabitants of Bengal; and, from every circumstance,

It is not necessary, however, to urge the *probability* of the account of any object of that description given by the pen of the amiable Heber. For, however mistaken his views may sometimes have been upon Indian affairs, in the short acquaintance which he was permitted to enjoy with that immense range over which his spiritual authority extended, we cannot, for a moment, doubt his exactness on such points as we are now considering; and as he was, at the time, accompanied by Mr. Boulderston, who had for many years held an official situation in that district, and from whom, Heber says, he derived much information on the natural history of the jungles they were then traversing, it is but reasonable to suppose, that the short description above quoted, was the result of the conversation and inquiry which this new and strange looking animal must naturally have given rise to.

I am happy to say, that, in as short a space of time as the great distance will permit, we may hope to have a full and particular account of the rough-coated elephant. Through the kindness of Dr. Wilkins, Librarian to the honourable the East India Company, in London, letters have been written to the gentleman who is, at present, engaged as a naturalist, in traversing some of the extensive districts of Hindostan, for the purpose of drawing his particular attention to this animal; and to all who enter into the consequences, to be naturally deduced from its discovery, a more particular description of it, from the pen of a naturalist, must afford a subject of the highest interest and expectation.

In the mean time, I must not omit to take notice of one point which has come under my observation, and which certainly corroborates, as far as it goes, my idea of the complete or approximating identity of species, between this existing caste of the elephant, and the shaggy fossil of Siberia, as well as between the common Asiatic race, and the animal whose bones and teeth are so generally distributed over the surface of the earth, and known by the name of the mammoth.

I have before alluded to the interesting specimens of the

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may be, with reason, considered as aborigines. They are in stature and figure very like the Welsh," &c.

"Most people conclude the climate of India to be invariably sultry and scorching, whereas the months of December and January are often so cold as to produce a thin coat of ice upon the puddles; and, very commonly, a smart hoar frost on the grass and vegetation."—*Field Sports of the East.*

skin and hair of the fossil mammoth of the Lena, preserved in the Museum of the Royal College of Surgeons, in London. After having examined the three different varieties of hair of which this sample is composed, viz. a sort of wool or short hair; a longer kind, about the coarseness of that of the mane of a horse; and a stronger sort, thicker than any bristle with which I am acquainted; I had an opportunity of seeing, in the same fine collection, the tail of the common Asiatic elephant, with the curious arrangement of hair of which it is composed. This hair is from one to two feet in length, and of such thickness, that it more resembles long rounded strips of whalebone, than any thing else to which I could liken it. The peculiarity of this coarse hair, however, is, that it is neither perfectly *round*, nor perfectly *flat*, as that from the tail of the horse is occasionally found to be; but it is *irregularly rounded and flattened* over its whole surface, in a manner so unlike any other hair, that it may, probably, be looked upon as quite peculiar to the elephant.* It immediately occurred to me, to compare this unusual construction with the coarser sort of hair of the fossil specimen; and though there is not in that sample, (which was sent to Sir Joseph Banks, from St. Petersburg,) any hairs which could be supposed to belong to the *tail* of the antediluvian animal, yet it is most obvious and surprising, to see the *exact similarity* which exists between the coarsest hairs or bristles of that sample, and those of the tail of the common Asiatic species.

Such corroborative points, in the chain of our evidence, are not to be overlooked, nor despised; and though Bishop Heber does not give us the slightest notion of the *colour* of the animal he saw, yet we may naturally conclude, from what we already know of the existing species, that it must have been of a dark brown tint, nearly approaching, in the coarser hairs, to black. If this be the case, it will agree, most perfectly, with the description I have *read*, and the samples I have *seen*, of the shaggy coat of the antediluvian animal.

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* The hair that is next in coarseness to that of the elephant's tail, is that of the tail of the cameleopard, which is of a fine round form, and from two to three feet in length. The hair of the hippopotamus is also very strong; but the skin of this animal is usually nearly bare. About the mouth are tufts of strong bristles—as also in the ear: and it is singular, that the form and arrangement of the tail should be the same as that of the elephant. Both are *flattened* towards the point, and the hairs are only on the edges, and not upon the sides of the flat part of the tail.

The coarsest hair in the Museum of the College of Surgeons, is, in colour, like that of some dark chesnut horses, which are often called black, but whose manes and tails show a reddish colour when viewed transparently. The tufts of hair from the fossil animal, evidently indicate an inclination to *curl;* the woolly hair, at the roots of the coarser sort, shows this even more distinctly; and the whole gives at once the idea of its having formerly belonged to exactly such an animal as Heber so graphically describes as being "*almost as shaggy as a poodle*," to which animal alone it could, perhaps, be properly likened.*

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* Since writing, the above, I have, by the kindness of the Zoological Society, been permitted to take specimens of the hair from different parts of the body of their small Ceylon elephant; and have compared them with the fossil specimens, in the presence of Mr. Clift, at the Royal College of Surgeons.

This small elephant in the Zoological Gardens of the Regent's Park, has not been many months in England. It is three or four years old, and is not yet larger than a small Highland ox. He is as hairy as many species of pigs; and his coat has a decided tendency to be "*shaggy*" or curly. His colour is a dark chesnut brown on the back, dirty gray on the stomach and lower parts of the body; and there is most hair, (of a yellowish colour,) about the mouth. In the interior of the ear, the hair is close set, and of a light gray colour, much resembling that called *wool*, in the descriptions of the Siberian fossil.

The keepers are conscious of the gradual increase of this hair, since the animal has been in England: and the older and larger Mysore elephant, of the same collection, has also a thin coat of hair, of a few inches in length, all over his body, and of the same colour as in the smaller animal. In both, the longest hair is on the neck and shoulders; but it has not yet assumed any appearance of a *mane*. It is, indeed, probable, that the mane described on the fossil specimen did not more resemble that of a horse, than the longer bristles always found on the neck and shoulders of the hog. Upon the whole, the small Ceylon elephant appears fast approaching to such a shaggy appearance as Heber describes, and as Mr. Adams found on the Siberian fossil elephant.

The resemblance of the hair of the fossil, and of the recent animal, is complete, having that general inclination to *red*, before remarked; and the longer hair of both is chesnut when viewed transparently, and so similar in this respect, that the one cannot be distinguished from the other.

I have, also, by the kindness of Mr. Cleft, been permitted to examine the tooth of a Siberian fossil, which was sent to Sir Joseph Banks at the same time as the hair. It is completely identical in form and structure to that of the common Asiatic elephant.

As we have now found, therefore, a situation, *within the tropics*, sufficiently cold to produce a thick coat of hair, on a race of animals usually bare; but, at the same time, sufficiently hot to furnish a climate fitted for the richest Eastern vegetation, and a jungle grass so high, as nearly to cover the elephants of the hunters, let us imagine, for a moment, such an event to occur, as is supposed by Cuvier to have *actually* happened in the present Polar regions, at the period of his *last* revolution, or, what we term the Mosaic deluge. Cuvier supposed that a SUDDEN flood of waters must have occurred, and, at the same time, an equally SUDDEN and violent *diminution of heat*, so as first to envelope the animals in the water, and then to convert that water, almost instantly, into ice; which has been the means of preserving, *in an entire state*, even the most perishable parts of some of the animal bodies embedded in it.

It must be obvious to every one, that if such an event were, at the present day, to occur in the jungles and forests in the vicinity of the Hymalaya range, now inhabited by a race of elephants more or less "shaggy;" and also by innumerable other animals of every sort, usually found in such latitudes, we should expect to find, on inspecting the frozen mass, that the animal remains were INVARIABLY *entire*, and, in no instance, exhibiting such decided marks of marine action, as *oysters*, and *other sea creatures*, firmly attached to them. Instead of prodigious beds of "*mud*," mixed with "*ice*," and "*bones*," so correctly described by Professor Buckland, as the state in which the shores and islands of the Polar seas are now found, we should look, with a confident expectation, amounting to *certainty*, for the mass of vegetable substances, and *entire trees*, which must have equally shared the melancholy fate of the unhappy elephants.

Such, however, is by no means the state of things in the latitude of the mouth of the Lena, in Siberia; and, as every thing there denotes total ruin, and diluvial confusion, we have a right to assume, as a demonstrable fact, that the theory of Cuvier is entirely groundless. It must, however, in justice, be admitted, that the shaggy coat of these fossil animals formed a strong and plausible ground for some such theory. But the enthusiasm, too common on the discovery of a new and interesting fact, was, in this instance, permitted to outrun the discretion so necessary on a point which was to lead to such sweeping conclusions. For the *undeniable facts* which were assumed from this discovery, led to the following unavoidable results; first, that ALL northern fossils must have been "*clothed in wool;*" secondly, that the remains of the same class of animals found in less rigorous climates, such as our own, were also *those of natives of such climates respectively;* and, thirdly, that the climates of the antediluvian earth, as well as the nature of its animal productions, must have been widely different from what they now are.

All these conclusions, and innumerable others which naturally flowed from them, we must now hold to be utterly *false* and *groundless.* Every thing denotes, on the contrary, that the earth, and its productions, have been *nearly*, if not *entirely*, uniform, ever since they came from the hand of the Creator. We have not yet discovered, it is true, an existing variety of the elephant, exactly similar to that which has received the title of mastodon among geologists; but, as we have now advanced so important and unexpected a step with respect to the mammoth, we may not altogether despair of still becoming acquainted, at some future time, with a *living mastodon.* Science is a plant of but tardy growth, even under the most favourable circumstances of civilized society; much more, then, in countries where such fostering care cannot be afforded for its protection. In our eastern possessions, for example, so far removed as they are from the parent country, there must still be the richest field for scientific research in every branch of Natural History. Our young men have, however, for the most part, hitherto gone out at an age when the mind is unprepared to take advantage of the vivid impressions which novelty affords. We soon become familiarized to what was, at first, new and surprising; and we are, afterwards, incapable of perceiving that, what is an every day occurrence in a foreign land, may prove of the highest interest to science in our own more cultivated societies. Thus, for example, has this shaggy race of elephants been seen, for years, by numbers of our countrymen, without any one having thought of its being more interesting than the common breed. Geology, or general science, is, probably, but little thought of, in a country where business must require all that exertion and energy of the mind, which is not dissipated by the debilitating effects of the climate. We have, it is true, made a most rapid progress in our knowledge of Natural History within the last half century; but, with almost all China, the greater part of Africa, and nearly the whole of New Holland, still before us, unexplored, we probably have much to learn, before we reach the boundaries of so wide a field for inquiry.*

When we consider, on the other hand, the unfathomable depths of the ocean, an element to which many of these animals must have belonged, which we now generally look upon as *extinct*, it must be admitted to be extremely probable, that many of our conclusions on that head have been inconsiderate and hasty. We have long been amused, from time to time, with reports of what have been termed *sea serpents*, of enormous dimensions; and these accounts, though coming from a great variety of persons and places, have usually been set down to the account of ignorance and fable. Without being, by any means, an implicit believer in such stories, I cannot but think it *possible*, and even highly *probable*, that there are still many things in the wide earth "but little dreamt of in our philosophy;" and that some such monsters of the deep may exist, and be occasionally seen, as has so often been asserted by many respectable persons.†

It was, formerly, one of the *well known facts* of geology, that there had once existed a species of CARNIVOROUS *elephants*. This extraordinary idea, arising from the form of the teeth of the mastodon, is now entirely exploded. It was, also, a prevailing opinion, and reasoned upon as another of these *well known facts*, that that animal must have been *a native of America*, as his fossil remains were only found in that country; thus encouraging the groundless notion, that the continents of the New World had existed, *as they now do*, before the flood.

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* We cannot peruse the Monthly Transactions of our different Scientific Societies, without perceiving descriptions of animals and things not already described, and entirely "new to Science."

† Amongst the fossil animals which are now looked upon as extinct, are some species of the saurian, or crocodile tribe. When we consider, that by far the greater part of the interior of Africa is still unexplored, and that we are but partially acquainted with the productions, even of its known rivers, we must suspend our judgment on the subject of the extinct species of the crocodile; and we may reason from analogy, that we shall still become acquainted with many new things; and may conclude, that every new discovery will tend to show the literal truth of the Inspired Record, and the provident care of the Creator, for the preservation of all created species. The crocodile of the Ganges differs much in form from that of the Nile, and greatly resembles one variety of the supposed extinct fossil species.

This idea has been subsequently proved to be as unfounded and false, as so many other parts of the theories of philosophy. It may be admitted, that the remains of this particular species of the elephant have been, hitherto, oftener observed in America, than elsewhere; and if it were necessary, it would not be difficult to advance very plausible theories to account for the predominance of the fossil remains of one species over another, in particular localities, in the same manner as we find the greater part of one deposit to consist of fish, and of another of bones, or shells.

Such currents of the ocean as now sweep along the coasts of New Holland, must, at the period of the deluge, have *somewhere* deposited those animal bodies which might have belonged *exclusively* to any similar portion of the former dry lands. In the direction of this branch of the currents, or in any of the eddies which it might chance to have occasioned, we should certainly look for such fossil remains as would be rarely found in other parts of the bed of the sea. In the event of such a calamity, in the present day, the peculiar animal and vegetable productions of New Holland would certainly attract a great share of attention, and be productive of much theory in philosophy, supposing that we had still remained ignorant of the existence of that immense country, and of its curious productions, as we were half a century ago. But, as my object is rather to treat of *facts* than of *theories*, I shall proceed to give an interesting instance of the fossil mastodon in our own country, and in the immediate neighbourhood of one of the most extensive and remarkable diluvial deposits with which we are any where acquainted. We know, that, in America, the remains of both the mastodon and mammoth are constantly discovered in the same soils. This circumstance would, of itself, be sufficient to destroy the whole theory of geologists, who confine the mastodon to America, as they do the gigantic elk to Ireland, or the Isle of Man, because his remains happen to have occurred in those countries, in several instances. One undoubted instance of the mastodon in Europe would be sufficient, then, for the support of the system we are now defending; and we cannot have the smallest doubt, that, however rare these instances may, as yet, have been, a more intimate and general acquaintance with the distinguishing features of the two fossil varieties, (which are only to be known by the form of the grinders,) will make us acquainted with many more instances than we have at present heard of.*

In a former part of this treatise, and in quoting from the interesting communication of Mr. Layton, on the fossil remains of the coast of Norfolk, mention is especially made of the skeleton of the "great mastodon" having been found *nearly entire*, in the neighbourhood of Norwich. Being desirous of ascertaining upon what certain grounds this skeleton was called that of the great mastodon, I wrote to Mr. Layton, to request some further explanation on the subject; and, in reply, I had the pleasure of receiving the following interesting statement.

"Your doubt, as to the great mastodon being found in Norfolk, came not at all unexpected. I should have doubted it myself under almost any other circumstances; as it is, I feel sure and certain of the fact.

"I lived at Catfield, in Norfork, six miles from Hasborough, and about as far from Horstead. From this latter place, marl (*soft chalk, with regular layers of flint, about four feet apart, or less,*) is carried to all the villages in the neighbourhood, to be spread upon the lands. A boatman, who was in the habit of bringing me fossils, brought a grinder of this mastodon as a curiosity, saying, it had been found in the marl, and given to him by the head pitman. It was the posterior portion of the grinder of the great mastodon, (I am certain of the fact,) containing, as far as I recollect, eight points, none of which had been cut, or brought into use. On the first opportunity, I went to make inquiry about it at the chalk pit. The pitman pointed out to me the place where it was found, and said, that the *whole animal was*, as it were, *lying on its side, stretched out on the surface of the marl.* He described it as being very soft, and that a great part of it would at first *spread like butter;* the whole, however, had been thrown down along with the marl, and carried away. He said he had looked upon it as *very curious* indeed, but *of no use;* and he had kept that piece of the tooth merely by accident. He afterwards found another fragment or two of the bones, in his garden, where he had thrown them, and he sent them to me. They are now in my possession, but I am not able to identify them with the *mastodon*, as distinguished from the *mammoth*, or elephant.

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* Professor Buckland mentions the bones of the mastodon as having formed a part of that remarkable fossil deposit, formerly alluded to, on the banks of the Arno, in Italy.

The grinder I sent to Dawson Turner, Esq., of Great Yarmouth, who, probably, has it now. Smith, in his 'Strata Identified,' has given the figure of a very fine grinder, (mastodon's,) said to have been found at Whitlingham, by Norwich; and Mr. Woodward, of Norwich, has a fragment, which appears to be half of one of the points of a mastodon's grinder, found at Bramerton, adjoining Whitlingham."

We have here the most clear and unquestionable statement of this interesting fossil body, and on the testimony of one, who not only possesses, perhaps, the most perfect collection of the teeth of the mammoth any where existing, (amounting to 70, of all ages and sizes, selected out of nearly 200,) but who has, also, made this curious part of geological research his particular study; and who, therefore, could not possibly be misled with respect to the animal in question, distinguished, as it so clearly was, by the form of its grinders. And we have thus a well-defined instance of the fossil existence of a species of animal, in our own soils, which has long been looked upon as exclusively confined to the continents of America alone.

One of the most remarkable features of both the known fossil varieties of the elephant, appears to have been the occasional horn-like, or spiral form of the tusk. It is the opinion of some able comparative anatomists, that all the tusks, even of modern elephants, have a tendency to this particular shape; but this opinion does not appear to be supported either by the fossil or the recent specimens of ivory. The largest recent tusks with which we are acquainted, have seldom been found to exhibit much indication of this form; and, on the other hand, many fossil tusks have been found as uniform in their bend as those of the common elephants most generally exhibited in Europe.*

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* It is highly interesting to trace the history of such immense animals as the elephant; and when we consider the high value that has, at all times, been set upon his tusks as an article of commerce, it appears surprising that the whole race has not, long since, become extinct. We know that elephants are in some countries hunted exclusively for the sake of their ivory, although some portion of our supply may also be derived from teeth found in the woods, when the animals die, or are destroyed by wild beasts. From the year 1788 to 1799, there was imported into Britain at the rate of 1576 hundred weight of ivory annually! Now, if we take the average weight of each tusk at 40 pounds, which is a very low estimate, we find that upwards of *two thousand* of these noble animals must have

We are not, however, to infer from these variable evidences, either that *all* fossil elephants had spiral tusks, or that *all* recent ones have those of a simple bend upwards.*

On this latter point, as upon the subject of the teeth of the mastodon, we must reserve our judgment until we have a more perfect knowledge of all the existing varieties. We ought to learn caution on subjects which involve such important conclusions, from the numerous instances we, from time to time, experience, of being forced to give up what had long been looked upon as well established facts. From such instances we may safely infer, that *nature* has not undergone such total changes as we are generally taught to suppose. The planet we inhabit, together with its animal and vegetable productions, remains governed by the same general laws it ever has been subjected to, since the creation. The *numerous revolutions* of the continental geology must, therefore, now be reduced to the ONE great revolution, recorded in the Inspired Writings, and of which we have now been tracing so many unquestionable proofs. We are thus, every day, more and more securely confirmed in the confidence to be reposed in these inestimable records; and the more closely we examine the evidences by which they are corroborated, the more striking is their resemblance to some deep bedded rock, on which the angry waves of scepticism are for ever breaking in vain.†

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perished each year, to supply the British market alone! Some tusks have been known to weigh from 325 to 350 pounds: and 100 pounds is not an uncommon weight; so that the above number is, probably, rather below than above the real annual consumption. If we add to this the supply necessary for the rest of Europe, and of the Eastern nations, our astonishment is excited at the number of elephants that must *annually* perish; and at the vast extent of wild country through which such herds must range, in seeking their subsistence.

* In the Museum of the College of Edinburgh, there are two very large fossil tusks, from Siberia. One of these is perfectly formed, with one simple bend; the other is very slightly of the cornuform, which appears, in that instance, quite accidental.

† Before concluding the consideration of the varieties of the fossil elephant, I cannot omit this opportunity of correcting an error in which our ideas of these antediluvian animals have been involved: and this explanation may serve to show how easily the public mind may be misled by the most trifling and casual circumstances. I am enabled to mention the following fact, on the authority of Mr. Clift, of the Royal College of Surgeons, who kindly communicated it to me, and has permitted me to make it public.

In the year 1799, a great fossil deposit, of animal remains, was discovered near Newburgh, on the Hudson River; and in this there were found so many bones of the fossil elephant, called the mastodon, that two nearly complete skeletons were constructed, with some little assistance from artificial means. The most perfect of these remained at Philadelphia, while the other was brought over for exhibition in London; and, in the year 1802, we were thus, for the first time, presented with a specimen of the *carnivorous* elephant, (as it was then thought to be.)

This curious specimen excited much attention for a time, and some idea of its purchase was entertained; but the price demanded being great, a report arose, and was soon circulated, that it was nothing but the skeleton of a common elephant, and was, therefore, not worthy of so much attention. This idea threatened seriously to affect the profits of the exhibitor; and, in order to prevent this, and to keep up public attention in favour of a highly ingenious and deserving individual, who had, at great expense, introduced so rare an object amongst us, the late Dr. Shaw, of the British Museum, suggested the idea of humouring the public; and, by changing the position of the tusks, thus giving a totally different appearance to the animal, and restoring its credit as a rare and interesting object. This idea was immediately adopted. The tusks, which had been very properly placed so as to point upwards, as in the common elephant, were now reversed, and placed downwards; and one of the great resemblances to the common race having now disappeared, the animal again came into public favour, and, no doubt, was considered as much more fierce and *carnivorous* looking than it was before, being thus furnished with hooks for the capture of its prey.

Drawings and engravings were made of the skeleton in this disguise; and, from that time to the present, the common impression of the public, with respect to the mastodon, is, that it was a fierce and *flesh* eating animal, and quite unlike the modern race of elephants. In a late number of a cheap and popular publication, intended for the diffusion of knowledge amongst the poor, the figure of the mastodon, or the mammoth, is accordingly given with the tusks placed in this unnatural and inconvenient position.

CHAPTER XIII.

Human Fossil Remains.—Why they cannot be so numerous as those of other Animals.—Lime-stone Caves and Fissures.—An Example in the Cave of Gaylenreuth, with its Fossil Contents.—Dr. Buckland's Theory of Caves and Fissures.—Human Fossils found at Guadaloupe.—Also at Durfort.—Great Fossil Deposits in Spain, containing Human Bones.—Quarries at Köstritz, containing Human Bones.—Natural Conclusions from the above Account.—Dr. Buckland's Conclusion respecting Köstritz inconsistent with other parts of his Theory.—Caves and Fissures in Lime-stone.—General spread of Diluvial Effects.

We now come to the consideration of a part of the subject of organic fossil remains in rocks and soils, which has, hitherto, occasioned very considerable difficulty, and has thrown a shade of doubt and uncertainty over the historical account of the deluge, which, however, appears to be totally unwarranted by facts. I allude to the rarity of *human fossil remains* amongst those of the animated beings, which are frequently discovered in such abundance on the earth. For, it is objected, if all the human race, excepting one single family, perished by the flood, at a period when the population of the world must have been very considerable, there can be no good reason given why we should not also find their remains in the same abundance as those of other animals, on every part of the surface of the present dry lands.

In reply to this objection, it may be answered, that there can be no doubt that we have a consistent right to expect, *occasionally*, to find such fossil remains. But that we should discover them in any thing like the abundance in which we find the remains of other animals, would be to expect what, from the very nature of the case itself, must be an utter *impossibility*.

When we look back to the early history of the world, and consider that man was created, *one male* and *one female*, from whom the whole human race was to spring; while all the other species of animated beings were produced "*abundantly*," and the earth at once replenished with them; we must readily perceive, that at the end of any given period, such, for instance, as the 1656 years between the creation and the deluge, there could be, *numerically*, no proportion between the race of man and that of other animals.* We should come to the same conclusion, even in our own times, and in the most populous countries, where, as in England, the number of inhabitants bears but a small proportion to that of quadrupeds and birds.† Much more then, if we extend our view generally, over the whole inhabited earth, where the immense forest tracts are peopled with *millions* of quadrupeds and birds, for every *hundred* of the human species.

For instance, if we conceive any such event as the deluge to happen to the continent of America, at the present time, when the wilds of that country are swarming with deer, wild cattle, horses, and every inferior race of quadrupeds and birds, with a human population, scarcely worthy of calculation, in proportion: we should feel no surprise, if, on being enabled to examine the wreck, we should discover the remains of the former, in thousands of instances, for one of the latter.* Instead, then, of exciting astonishment, or creating doubt, the circumstance of the *comparative rarity of human fossil remains*, ought rather to be looked upon as the strongest confirmation of the general history of the earth, which we are now considering. We must keep in mind, too, that it is only within a few years, and in a very confined portion of the whole earth, that fossil remains, in diluvial formations, have excited the attention which they now do: and that before the study of comparative anatomy became so common as it now is, many bones must have been frequently discovered which ought to have been considered under this head, but which were, in ignorance, mistaken for those of other animals, or attributed to some more recent era. It is certain that, at all times, since the deluge, such remains must frequently have been found; but, in the ignorance and darkness of past ages, these instances have generally been overlooked and forgotten. Besides, as such discoveries must almost always be made, even in our own enlightened day, by the most ignorant of the people, instances must still frequently occur, which would be of the highest interest to science, but which are lost or forgotten from the thoughtless ignorance of the peasants who discover them.†

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* "The kingdom of Congo, like most other parts of Africa, produces a prodigious variety of wild animals. Amongst the most remarkable are the elephants, which are found chiefly in Baurda, a province abounding with woods, pastures and plenty of water. They go in troops of 100 or more, and some are said to be of so monstrous a size, that the prints of their feet measure from four to seven spans. They delight in bathing during the heat of the day. Lions, of immense size, tigers, wolves and other beasts of prey, abound in this country. The zebra, the wild ass, the buffalo, and numerous tribes of deer and antelopes, are all most abundant; and the forests swarm with hyænas and wild dogs, which hunt in packs with dreadful howlings."—*Bibliot. Univers. de Voyages.*

† The population of England, which is not exceeded by that of any country in Europe, in proportion to its extent, is about ten or eleven millions. It is calculated that there are about twenty-six millions of sheep in this country alone; and if we include Scotland and Wales, where the disproportion is infinitely greater, we may form some tolerable idea of how the matter stands, when we add to the sheep, every other species of quadruped and bird, with which our woods and plains are so abundantly peopled.

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* "The Missouri and Arkansas territories, which would be capable of sustaining, probably, more than fifty millions of inhabitants, if in a state of civilization, are, at present, occupied by something more than one hundred thousand Indians; and they have been computed to contain about one million of square miles."

"The buffaloes go in immense herds, and no one, ignorant of the extent of these fertile prairies, can form any idea of the countless myriads that are spread over, and find support on them."—*Hunter's Memoirs of his Captivity among the North American Indians.*

"On the south of the river Saladillo, (in Buenos Ayres,) are the immense plains of Pampas, which present a sea of waving grass for *nine hundred miles*. Their luxuriant herbage affords pasture to innumerable herds of cattle, which rove about unowned and unvalued: they are, also, the abode of immense troops of wild horses, deer, ostriches, armadillos and every sort of game."

† On three several occasions, I have lately had opportunities of remarking the careless apathy with which discoveries, most interesting to science, were regarded, both by overseers and labourers, in extensive works, where objects were every day discovered, most likely to attract their curiosity and attention. In the coal mines,

This darkness is, however, at least in our own country, passing rapidly away; and the love of science is now spreading from our own shores into every part of the habitable globe; from whence, we may hope, that the instances of diluvial *human fossil-remains* will soon be greatly accumulated, and will afford us, from year to year, additional corroborative evidences of the true history of the earth. When we consider, indeed, the few spots on the surface of the globe, either by art, or by nature, laid open to our inspection, we ought, perhaps, to feel surprise at the extent to which our knowledge has already attained.

There is no part of the systems of geology, of the present day, in which more scepticism is evinced than in the instances which have occurred of *human fossil remains;* and it has even been, by some, considered nearly certain, that human beings *had not been created* at the period when the other animals, whose remains we find in a fossil state, were the inhabitants of the earth. The instances of human remains, which have been, hitherto, discovered, are not indeed numerous; but they are abundantly sufficient for the support of the general system now under consideration: and the instances which I am now about to mention, bring this branch of our subject, in the most natural and consistent method, within the very same class of facts, as those we have been, hitherto, occupied in passing under our review.

Before entering upon these statements, however, it may be necessary to say a few words upon the subject of the limestone caves and fissures, in which such animal remains are so generally found. The nature of some lime-stone rocks to split into fissures, and to become perforated in all directions, by cavities more or less extensive, is well known to have

both of England and of Scotland, I have seldom met with any workman who was aware that trees and plants were visible in almost every part of their works; they have no difficulty in admitting the fact when pointed out to them; but the situation of these remains must appear so improbable to them, that they would scarcely credit the evidence of their senses. One pitman, in a Scotch coal mine, appeared, however, to have viewed the interesting objects around him with more attention. Observing that I held my light towards the walls and roofs of the gallery, without, however, having made any remark to him, he said, "there must have been fine confusion here, sir, in the time of Noah." I could not help wishing that this remark had come from some leading member of our scientific societies.

given rise to one of their geological names, that of *cavous limestone.* This particular character is, as may naturally be supposed, not confined to any country, nor to any district; but is as universal as the extensive secondary formation to which it belongs. Accordingly, innumerable instances of such cavities may be found in all countries; but they have, of late, come more especially into notice from the organic remains of diluvial destruction, which they have, in a great variety of instances, been found to contain. The cave of Gaylenreuth, in Franconia, has long been celebrated for such animal remains; and as an account of one will serve to give a very general idea of all such caverns or fissures, I shall here give Dr. Buckland's account of it; without, however, entering, in any degree, into his theory of the means by which the animal remains of this, or other caves, came into their present remarkable situation.

"The mouth of this cave is situated in a perpendicular rock, in the highest part of the cliffs, which form the left side of the valley of the Weissent river, at an elevation of more than 300 feet above its bed. We enter by an aperture, about seven feet high, and twelve feet broad; and, close to it, we observe an open fissure rising from the cave, towards the table-land above.* The whole consists principally of two large chambers, varying in breadth from ten to thirty feet, and in height from three to twenty feet. The roof is, in most parts, abundantly hung with stalactite; and, in the first chamber, the floor is nearly covered with stalagmite, piled in irregular mamillated heaps, one of which, in the centre, is accumulated into a large pillar, uniting the roof to the floor.*

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* It may here be important to remark, that nearly the whole of this part of Germany forms one great table-land, of little variety on the surface, and in which the rivers, (and amongst others, the Rhine,) run, as it were, in trenches, the sides of which often present a perpendicular section of this whole secondary formation; and the sameness of character in both sides of which greatly detracts from the beauty of the scenery for which the Rhine is more particularly celebrated. That all this plain country, connected as it is with the lower levels of Belgium and Holland, on one side, and of Poland and Russia on another, once formed the bed of the sea, is a fact so generally admitted, that it is here unnecessary to dwell upon it. The period at which this state of things existed becomes a more important question; and if I have succeeded in proving that the chalk formations of France, and of England, were in this state immediately previous to the Mosaic deluge, and by that event were elevated to their present level above the waters, we can have no hesitation in carrying the same level, and the same line of reasoning, over all those plains of Germany, in which these cavities are found.

"From the first chamber we descend, by ladders, to a second, the floor of which also appears to have been overspread with a similar crust: this, however, has been nearly destroyed by holes dug through it, in search of the *prodigious quantities of bones* that lie beneath. This last chamber is connected by a low and narrow passage, with a smaller cavern, at the bottom of which there is a circular hole, descending like a well, about twenty-five feet, and from three to four in diameter. The circumference of this hole, in descending, is, for the most part, composed of a breccia of *bones, pebbles, and loam*, cemented by stalagmite. The depth to which this extends has not yet been ascertained. The roof and sides of all the artificial cavities, (formed in the search,) *are crowded with teeth and bones:* but these do not occur in the roof or sides of any of the upper, or *natural* chambers, above the level of the stalagmitic crust that covers the floor. This observation applies equally to all other lime-stone caverns of this description, and is important on account of the erroneous statements and opinions which exist on this subject. The floor of the first chamber has been already stated to be almost entirely covered with a crust of stalagmite. Through this crust large holes have been dug, and in these we see a bed of brown *diluvial loam* and *pebbles*, mixed with angular fragments of *rock*, and with *teeth and bones*. I could not ascertain the depth of this diluvium.

"In the second chamber the formation is of the same description, but *more abundantly laoded with bones.* Its depth appears to be irregular, and, in some parts, extremely deep. A side chamber descends rapidly into the body of the rock, and contains *cart loads of teeth, bones,* and *pebbles*, dispersed through a loose mass of brown diluvial loam, but not united by stalagmite." "The distribution of the component materials of the breccia of these caves is irregular; in some parts the earthy matter is wholly wanting, and we have simply a congeries of *agglutinated bones;* in others, the pebbles abound; in a third place, one half of the whole mass is loam, and the remainder *teeth* and *bones.* The state of preservation of these animal remains, when incrusted with stalagmite, is quite perfect, and the colour a yellowish white."*

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* When water is filtered through lime-stone, it becomes impregnated with a calcareous principle; and when exposed to evaporation in the atmosphere, it deposits a stony matter, in the same form as icicles in a moist cave or cellar; such stony icicles are often seen dependent from the arches of bridges lately constructed, being formed from the mortar used in the building. When the matter is formed on the roof of a cave, it is called stalactite; when on the floor, it is named stalagmite.

This cave of Gaylenreuth is only one of many such lime-stone caverns in the same neighbourhood, all furnished, in this manner, with similiar witnesses of diluvial destruction.

Dr. Buckland's account of the cave of Kühloch is truly remarkable. "It is literally true," says, he "that in this single cavern, (the size and proportions of which are nearly equal to those of a large church,) *there are hundreds of cart-loads of black* ANIMAL DUST, entirely covering the whole floor to a depth which must average, at least, six feet, and the cubit contents of which must exceed 5000 feet. If we allow two cubic feet of dust and bones for each individual animal, we shall have, in this single vault, the remains of at least 2500 BEARS, a number which MAY HAVE BEEN SUPPLIED in the space of 1000 years, by a mortality at the rate of two and a half per annum."

Dr. Buckland's theory of the mode by which such animal remains became enclosed in caves, in every similar situation, is simply, that all such caverns were, before the deluge, *inhabited by wild beasts*, which, in some cases, as at Kirkdale, *accumulated the bones of their prey in great quantities in their dens;* and in others, as in the above mentioned caves of Germany, the animals died a natural death, when their decomposed remains were gradually added to the common stock; and while the diluvial currents were in force, the waters, filling these caverns, and drifting into them a mixture of mud and rolled pebbles, the whole mass of loam, gravel, and bones, subsided into the hollows of the cave, became mixed up together in the confused state we now find them; and, in the course of subsequent years, the whole surface became incrusted with stalagmite, often forming a hard and stony breccia.

As to the bones of animals, accompanied with loam and gravel, contained in the *fissures*, or more confined cavities of lime-stone rocks, Professor Buckland looks upon it as certain that these were *open fissures before the deluge*, and that numbers of the wild animals of that period, endowed, it would seem, with a much smaller degree of natural instinct than those of our own day, carelessly wandering among the woods and pastures, *fell in*, and *perished*. That the bones of these animals were of a much *less perishable* nature, than in our own times, is thus evident; for, during the whole period, previous to the deluge, or for upwards of 1600 years, these open fissures preserved their animal prey; and when the diluvial gravel and earthy sediments came to be lodged in them, the whole of the bones were not compressed at *the bottom*, as we should naturally have expected, but were mixed up in complete chaos, together with these earthy sediments in every part of the fissures; though they are, in numberless cases, of prodigious depth and extent.

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* Reliq. Diluv. page 133.

Had the above theory respecting caves, being formed upon the solitary instance of *one* cave, or even a set of caves in the same locality, containing the bones of *one species of animal*, such, for instance, as *bears*, we might have looked upon it as not only highly ingenious, but as having even much appearance of probability: but when we extend our view over the whole earth, and coolly examine all the circumstances of innumerable cases, of a similar nature, we cannot fail to perceive the inconsistency of the whole theory, and consequently, that the abovementioned "ANIMAL DUST" must be attributed to a different cause from that of the gradual decay of "TWO THOUSAND FIVE HUNDRED BEARS *in the space of* 1000 *years*, *at the rate of* TWO AND A HALF *per annum*!"

Amongst other proofs of the solid foundation on which this singular theory has been offered, and so generally accepted as satisfactory, by the scientific world, we must be informed, on the surest evidence, of some one *post-diluvial cave*, inhabited, like Gaylenreuth, *by hundreds of bears at the same time*, and of the unnatural habit of these animals to admit of even *two and a half putrid carcasses* in the year, to rot and moulder to a black "*animal dust*" under their very feet. The range of the Jura mountains is the exact situation where the professor's search ought to be directed; for there, in a climate very similar to that of Germany, are to be found, in considerable abundance, not only bears in the most savage state, but caves and fissures, of lime-stone rock, of exactly a similar nature. In Geneva, the tables of the curious are every winter spread with this species of game; and the peasants, on both sides of the Jura, are so partial to the chase of the bear, that his haunts and habits are as well known as those of the red deer to the Scottish Highlander. We may add a hope, that the Zoological Societies of London, with that zeal for scientific information for which they are so distinguished, will turn their attention to this important and interesting trait in the natural history of the bear.

I shall now proceed to lay before my readers the accounts of such undoubted instances of human fossil remains as are at present known to science: and that I may avoid, as much as possible, all appearance of prejudice, in favour of the views I am at present supporting, I shall quote the statements of these instances from the works of writers who have held very different opinions from myself; and who appear, in some instances, to have written these accounts under a general and commonly received impression, that any thing, of human form, could not be of *antediluvian* date, or, strictly speaking, *fossil.* It is not difficult to trace this very common, though erroneous impression, to those theories of geology, which cannot imagine any stratum, or formation of rock, to have taken place, except *in the course of a very long period of years;* and by which the immense, yet indefinite age of the globe, is thus looked upon as a firmly established fact. By those theories, a regular *succession of creations* is taught; the animals, found in the *lowest secondary strata,* being, as a matter of course, *less recent* than those whose remains are found above them. Man, therefore, having been rarely found in a fossil state, his remains, when discovered in rocks or soils, are generally regarded as *accidental occurrences,* arising from ancient battle fields, falling into fissures, or the like.

It may, however, be safely asserted, that in the whole history of fossil animal remains, there is nothing more clearly defined, or more completely certain, than the antediluvian date of many human fossils; and it is to be hoped, that the following statements will at once be stripped of all their mystery, to those who have entered into the line of reasoning adopted in this treatise, with respect to the newer secondary, or *diluvial* strata of the earth.

The first account which I propose considering, is contained in a letter from Mr. König to sir Joseph Banks, published in the Philosophical Transactions for 1814. It relates to the *human remains embedded in lime-stone rock,* at Guadaloupe.

"All the circumstances," says Mr. König, "under which the known depositions of bones occur, both in alluvial beds, and in caves and fissures of the flœtz lime-stone, tend to prove, that the animals to which they belonged, met their fate in the very places where they now lie buried. Hence, it may be considered an axiom, that man, and other animals, whose bones are not found intermixed with them, did not coexist in time and place. The same mode of reasoning would fully justify us in the conclusion, that if those catastrophes, which overwhelmed a great proportion of the brute creation, were general, as geognostic observations, in various parts of the world, render probable, the creation of man must have been posterior to that of the genera and species of mammalia, which perished at the great cataclysm, and whose bones are so thickly disseminated in the more recent formations of rocks."

I must here remark, that it is not my object, in this place, strictly to criticise the very interesting paper from which the above is taken; but I quote the preface, in order to show the general impression under which the whole of this account was written; an impression which was then pretty generally felt amongst all geologists.

After nearly 20 years of additional experience and knowledge in this interesting science, it may be, by some, considered scarcely fair to bring forward the written opinions of those *early times;* and I should certainly feel disposed to take this view of the subject, were it not that, however the geological views of the able author of this paper may have changed, with regard to human fossil remains, it must be admitted, that the general impression on this branch of geology, is, at the present day, exactly such as is so clearly defined in the above passage: and when we consider the importance and weight which are very naturally attached to the opinions of the great leaders, in the scientific, as in the political world, we cannot but admit the necessity which brings those public and important documents under our strictest review.

"The human skeletons from Guadaloupe, are found in that part of the windward side of the *grande terre*, called La Moulle; and they are enveloped in what M. Lavaisse, in his Voyage à la Trinidad, (1813,) calls 'Masses de Madrèpore petrifiès.' The block brought home by sir Alexander Cochrane was about eight feet long, by two and a half wide, and one and a half thick, being of nearly two tons weight. Its shape was irregular, approaching to a flattened oval. Excepting the few holes, evidently made to assist in raising the block, there were no marks of a tool; and, indeed, the whole had very much the appearance of a huge nodule, disengaged from a surrounding mass. The situation of the skeleton in the block was so superficial, that its presence in the rock, on the coast, had, probably, been indicated by the projection of some of the more elevated parts of the left fore arm."

Mr. König then proceeds to describe minutely the deranged condition of the bones, and states, that the whole of them, when first laid bare, had a mouldering appearance; but, after an exposure of some days to the air, they acquired a considerable degree of hardness. The calcareous rock in which these human remains are embedded, is an aggregate, *composed chiefly of* ZOOPHYTIC PARTICLES, and the detritus of common lime-stone. Its general colour is grayish yellow, and it is harder than statuary marble. *There were shells in the mass;* one of which appeared to be the *turbo pica* of Linnæus; it was in a worn state, and the brown spots were still distinctly seen on its surface. "Besides these bodies," continues Mr. König, "I found near the surface of the block, part of a bone of a concentric lamellated structure, apparently the fragment *of a tusk*, but of what animal I was unable to define. From this description of the rock, it will be sufficiently clear, that it is by no means of a stalactetic character, and, therefore, cannot be compared either with *travertino, or any other chemical calcareous deposition of this kind.* Its origin seems unquestionably to be that of *common sand-stone;* only, that the grains of which it is composed, have, in some parts, become *confluent*, and have formed *a nearly compact lime-stone.*

"Respecting the age of these fossil remains, if not much positive information can be derived from the preceding details, this will prove, at least, that the enveloping rock *is not of a stalactetic nature;* and that the bones, after they were deposited, underwent a degree of violence, which dislocated and fractured them, without removing the fragments to a distance from each other. It may, therefore, be safely concluded, that the surrounding mass must have been in a *soft* or *semi-fluid* state; which, whilst it opposed no effectual resistance to a shock from without, readliy filled up the chasms produced by it." M. Lavaisse, above mentioned, states, that 'the bed of lime-stone in which these nodules, containing, in many instances, human fossil bones, are found, is nearly an

English mile in length along the shore, and is covered by the waves at high water.' "

The head is wanting in this most interesting fossil specimen, and, also, the right arm, both the feet, and the ribs of the right side. Notwithstanding, however, this imperfect condition, the general form stands in high relief from the embedding lime-stone; and as the block is placed in an upright posture, the beautiful proportions of a female form, which appears to imply *youth*, and a striking, though fortuitous resemblance to the position of the celebrated Venus de Medicis, gives to the whole a degree of intense interest, which no other known fossil can, in the least degree, lay claim to. For, in contemplating this form "of other days," the mind experiences a mixed feeling of wonder, of curiosity, and of commiseration. We long to be made acquainted with the personal history, and to take an interest in the mental feelings which once belonged to this mortal form. What a tale of woe could she unfold, if now again endowed with speech! The dreadful scenes of her latter days would present a picture, which the most lively imagination is totally incapable of conceiving.

The mind derives a painful pleasure in dwelling upon the subject, and in tracing, in various colours, the incidents, the language, and the feelings, by which this stony body was once influenced, in a degree, as acute as we ourselves experience. The skull of Yorick is as nothing, when compared to this, as a moral lesson; for in the delicate female form now before us, we contemplate the actual bodily remains of one, who has painfully experienced the terrible judgments of an OFFENDED DEITY.*

I shall close this short, but interesting account of the human fossils of Guadaloupe, with the remark, that no hesitation could have been felt *as to their being of antediluvian origin*, had they been the remains of *quadrupeds*, and not of the *human race*: but so strong is the effect of pre-conception, that, although every thing here tends to demonstrate the fact in the clearest manner, yet the mind of the very able geologist I have just quoted, found a difficulty in admitting a fact so entirely inconsistent with all the received laws of the continental theories of geology.

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* In a former arrangement of our great national museum, this, the most interesting of all known fossils, occupied a highly conspicuous place. At the present time, it is concealed in an obscure corner of an obscure closet. It is to be hoped, that the managers of the British Museum will make such arrangement as may again exhibit this specimen, as it so well merits, in "the place of honour" of our splendid collection.

We cannot question, however, the clearness of the fact, that this interesting specimen *is the mutilated body of an antediluvian female, which, having lost the head, and being, in other respects, far gone in decay, became embedded, in this shattered state, in the muddy sediments of the diluvial waters;* which sediments, composed of *shelly detritus*, and having, also, embedded in it the tusk of some quadruped, and various known marine shells, has since been hardened into "*a nearly pure lime-stone.*" When we examine the specimen of the crocodile, taken from the quarry at Shotover, (and now in Professor Buckland's collection at Oxford,) *having sea shells attached to it*, we never, for a moment, doubt that it was of antediluvian origin. Let us judge of this *human fossil*, accompanied, in like manner, by marine productions, with the same degree of candour, and with an unprejudiced mind; and the theories which thus contradict the inspired narrative, with respect to the period of the creation of man, must for ever fall to the ground.*

I now proceed to state the phenomena exhibited in the lime-stone formation at Durfort, in France, as they are detailed and published by M. D'Hombres Firmas, in the seventeenth volume of the Biblioteque Universelle, for 1821, p. 33.

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* There cannot be a doubt, that if this lime-stone bed, on the sea shore of Guadaloupe, were properly examined, or if there were occasion to intersect it by quarries, we should soon obtain many other conclusive and undeniable proofs of its diluvial origin. A stratum of "pure lime-stone" cannot be supposed to extend a mile, or more, along a coast, without also extending laterally, in an inland direction, for a considerable distance. It has been long looked upon as the most probable origin of this bed, that the waters of the sea having, in many instances, a property of rapidly depositing calcareous matter, must have cemented together the sands upon that coast, and thus petrified every substance that happened to be embedded in them. This, it must be admitted, is taking a very prejudiced and limited view of the subject; for a conglomerate, thus formed of the varied particles of a common sea beach, would present a very different appearance in the fracture, from what is exhibited in the close and equal texture of the specimen in the British Museum. There can be no doubt, that in a formation, containing one human fossil, accompanied by one *tusk*, and various shells, we might, on further inspection, discover such animals as that tusk must have belonged to, besides many other equally distinct proofs of the true period of the origin of this interesting formation.

M. Firmas opens his account of these phenomena, by remarking, that the environs of Durfort, near Alais, in the department of Garde, in the South of France, are of the highest interest to mineralogists, from the mines of calamine, crystals of barytes, and other minerals, which are abundantly found in that neighbourhood; where are, also, displayed "the most astonishing quantities of silicious, calcareous, and pyritous *petrified* SHELLS, some of which are of the rarest sort."

When M. Firmas was, for the first time, at Durfort, in 1795, he was informed by the peasants of the existence of a cave, which contained what they called *petrified men*.

He, at first, thought that this idea must have arisen from the *stalactetic formations* common to lime-stone cavities; and that the ignorant superstition of the peasants must have attributed to these the supposed human form. They added, however, the supposition, common in the country, that after some very ancient battle, the dead had been carried to this species of catacomb, which was every where known by the name of the *Baoumo das Morts*. These reports, however, made him very desirous of visiting the cave, and he was, accordingly, conducted to it, a little way to the north of the village, and almost at the top of the mountain of Lacoste, which is "of the old limestone formation," and the height of which is about 500 feet above the level of the Mediterranean. The mouth of this cavern consists of a fissure in the rock, into which one is obliged to descend nearly perpendicularly for above 10 feet, pressing, with the back and the knees, against the sides of the fissures, as chimney-sweepers do. They at length entered the *baume des morts*, which is a cavity not more than 10 or 12 feet in its greatest width, and in which a man of common stature can scarcely stand upright. The roof, the walls, and the whole interior of this cave, are lined with stalactite of a dirty white colour, approaching to brown. It is neither vast nor brilliant in its interior. "The unequal ground on which he stood, *was formed of bones, covered with stalagmite*, filling all the intervals which had separated them, and forming a solid mass of various dimensions."

"We detached some fragments from this mass, by means of a hammer and chisil; they were filled with bones, which we recognized as human, or, at least, the greater part of them; for there were many *so broken and incrusted*, that we could not decide whether they belonged to our own species, or to the bodies of other animals.

"We have shown these bones, such as *the cranium*, *the jaws*, and other parts, to some of the *savans* at Paris, and they admit not of a doubt as to what they must have originally belonged to. They seemed thrown together, pêle-mêle, in the pâte, which incloses them; and they are in such quantities, that they formed more than the half of the whole mass."

M. Firmas then attempts to account for the circumstances and phenomena attending this remarkable cave; in doing which, he first attributes the stalactites to the action of *running water;* and then very naturally asks, where that water could have come from? "For," says he, "the mountain of Lacoste is entirely separated from all the neighbouring heights; and the brooks, which run between these heights, are, consequently, very low. The rains could not have occasioned them, as it is evident that these stalactites have not made any perceptible progress in the course of the last 25 years.

"This grotto is not accessible to quadrupeds; the bones which it contains do not appear to have been worn by rolling: it could not have been a burying-ground of the country; for they never would have chosen a place so distant, and in the midst of the woods; besides, it would have been too difficult to have introduced bodies by the fissure through which we descended; and we looked in vain, in every part, both of the interior and exterior of the cave, for any other opening.

"There exists," says he, "in other countries, similar deposits of bones. We need not speak of those of Germany, Hungary,* Gibraltar, and the Archipelago; but the human bodies found near Soissons, in 1685; petrified bodies found in Guadaloupe; the incorporated bones in calcareous rocks, in a cave in Somersetshire; and also those of this Baume des Morts, are all evident instances of the fossil remains of our own species."

There is little occasion for further remark upon the fossil remains found in this cave: they are evidently attributable to the same diluvial cause, by means of which the innumerable lime-stone caves of all secondary countries have been so abundantly furnished. In our own country we have a vast variety of instances of this sort; many of them have been very fully detailed by Professor Buckland, in his Reliquiæ Diluvianæ; but from the particular geological theory which has arisen in consequence of his views, with respect to the cave of Kirkdale, viz. *that it was inhabited by hyænas before the flood,* who preyed upon the ELEPHANTS and RHINOCERI *which pastured in the forests of Yorkshire,* the true causes of such animal deposits have been hitherto, in a great measure, distorted or concealed. Having elsewhere shown the total fallacy of the whole of this theory, it follows that we must look for a principle less contradictory, and more consistent with the laws of nature, and with the phenomena themselves. This principle I have already, in some degree, explained; but I shall reserve the few remarks I have further to make upon the subject, until we have perused the details of the other fossil deposits connected with this branch of our inquiry.

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* In the Carpathian chain of mountains, in Hungary, grottoes are very numerous, in some of the calcareous strata. The principal of these are, Mazarna, and Dupna, in the district of Thurotz; Drachenhole, in that of Liptau; Holgoez, in Zips; Altelek, in Geomor; and Sziliacz, in Torn. Bones and skeletons, partly petrified, are found in these grottoes; and the most beautiful stalactites of every size and form.

The third remarkable instance of indiscriminate fossil remains, in which *human bones* have been very frequently found, is an immense congeries, displayed in a hill called *Cueba Rubia,* (or red cave,) near the village of Concud, in the province of Arragon, in Spain. This hill takes its name from a kind of red diluvial earth, which has been intersected and laid open by the waters of a mountain stream. Some of the bones contained in it are of the nature of common church-yard bones; some are solid, and well preserved; others seem pulverized, and fall to pieces on exposure to the atmosphere. They belong to a great variety of animals, and lie confusedly huddled together, or, as the French term it, *pêle-mêle.* Seven or eight human shin bones are frequently seen in one spot, without any other parts of the body. There are many articulations of the larger bones of animals mingled with them; and they are often filled with a crystalline substance. Don Guillermo Bowlês relates, that he was informed of an entire human skeleton that had been there discovered: the thickness of this diluvial mass is described as being upwards of 60 feet. We have, in this remarkable instance, a complete identity of character and circumstances, with numerous other fossil deposits, which are of unquestioned diluvial origin: but, as is usual, wherever *human bones have been found intermingled,* it has been the custom with geologists, in their remarks on this mass, to attribute the whole to some comparatively recent cause. A candid and unprejudiced judgment of the facts cannot, however, fail to lead us to a very different conclusion.

Before proceeding to make any remark upon the similarity which obviously exists between the cave of Durfort with its fossil contents, and those of Kirkdale, Gaylenreuth, and so many others in all countries, now so well known to geologists, I shall proceed to the details of the only other instance, which I consider it necessary for my present purpose to produce; and should any doubt have still been felt on the subject of *human fossils*, in the accounts of the three instances just given, I imagine that the following statement will for ever set this question at rest; for it has long been admitted, on all hands, that any ONE *unquestionable instance of antediluvian human remains* would be perfectly sufficient for the solution of that dark mystery which has so long obscured this part of the history of our earth.

The following account is written by the Baron Von Schlotheim, and was published at Gotha, in 1820. It was translated from the German by Mr. Weaver, and laid before the English public in the Annals of Philosophy for 1823.

"The recent discovery of human bones, as well as those of other animals, in a fossil state, in the neighbourhood of Köstritz, cannot fail to render a description of that district interesting to naturalists in general. I had an opportunity of examining that part of the country this spring, (1820,) in company with M. Braun, Counsellor to the Land Chamber, a gentleman distinguished for his exact mineralogical knowledge. Its geological relations are so well exposed in the ranges of hills, and in the quarries on their declivities, that no room is left to doubt the disposition and order of succession of the different floetz formations which appear in that vicinity.

"The valley of the Elster extends from Köstritz to the north, in an average breadth of about two and a quarter English miles, flanked by heights, which are covered with fertile fields, and slightly wooded. These eminences form connecting ranges on both sides of the Elster, passing Politz and Kaschwitz; that on the east, near Politz, attaining the greatest elevation. The bottom of the valley itself is perfectly smooth, refreshing the eye with its verdant meadows, diversified with groups of trees.

"The foundation upon which the floetz formation reposes, consists of transition *reddish gray clay-slate*, and firm, fine-grained graywacke. The former rests on the graywacke, and is immediately covered by the *older* floetz lime-stone, which rests upon it nearly in a horizontal position." I give these details as they are found in Mr. Weaver's translation of the baron's paper. The names given by the continental geology to the various upper strata, have been adopted upon the usually received principle of *the position of each formation marking its comparative age*. We have, however, found the strongest reason to do away, in many instances, with such terms as "the oldest floetz lime-stone," as it is obvious, both in this instance of Köstritz, and in the basin of Paris, each exhibiting proofs in the solid gypsum, *of distinct diluvial formation*, that many of these upper strata, and EVERY INSTANCE *where bones of quadrupeds are found embedded in the solid substance of the rock*, must be attributed to the destructive period of the Mosaic deluge, and cannot, consistently, be considered as the formation of any other former period.

"*The lowest strata are sandy*, and occasionally somewhat *bituminous*. In the upper strata, the sand, mica, and bitumen, entirely disappear, and, in their stead, traces of *yellow ochraceous iron-stone become visible*.

"The lime-stone, just described, ranges principally on the left bank of the Elster, towards Gera, as far as the vicinity of Hartzmansdorf; and again, on the right bank, near Politz, where it is well displayed in several quarries. On the other hand, the *gypsum*, *which is embedded in*, *and subordinate to this lime-stone*, occurs at the foot of the opposite range, on the west, near Köstritz and Kaschwitz, in the whole of which extent, the numerous gypsum quarries afford an insight into its character. The depressions and sinkings of the earth, which occur in the valley, proclaim that we have entered upon the domain of the cavernous gypsum and lime-stone, the latter of which is, as usual, covered by the variegated or new red sand-stone formation, which appears near Hartzmansdorf, and on the ridge of the chain of heights near Politz. Over the whole of these floetz formations, is spread an alluvial loamy tract, which is sometimes sandy, extending many miles, and yielding to the landholder a rich return, when duly cultivated."

I cannot here avoid remarking the distinct and luminous character of the above description of the Baron Von Schlotheim; which is so clear, that, without having visited the spot, one can distinctly form a correct idea of the whole structure of that country.

It appears, that in no other situation are there to be found more convincing proofs of diluvial action having filled up a hollow, or basin, in the bed of the antediluvian ocean; and the principles of stratification, which have been before explained, are here exhibited, in the most beautiful manner, having the *finer deposits lowest*, and the coarser sands, gravels, and loams, being thickly spread upon the upper surface; the whole mass, *where pressure has taken place*, having been acted upon by those chemical laws of nature, the origin of which must for ever lie concealed from our view.

After the above concise general view of the country, M. von Schlotheim proceeds to give a nearer description of the lime-stone and gypsum formations, with a detail of the circumstances under which the bones of land animals are now frequently discovered in these rocks.

"The varieties of this lime-stone formation have obtained different appellations from miners; amongst which, that of *zechstein* is one of the principal. Near Politz, this zechstein appears particularly to prevail, which passes into the cavernous lime-stone, being traversed immediately under the new red sand-stone, by very considerable fissures, and cavities, which often extend 12 feet in breadth, the whole of which are coated with stalactite, while the smaller fissures are frequently wholly filled with that substance. In the vicinity of Gera, the rock appears as *gryphite lime-stone*, yielding fine specimens of *Gryphites aculeatus*, and *G. cymbium*, *besides indistinct remains of other shells;* on the other hand, in the Politz lime-stone, I have not observed any petrifactions of shells.

"At the latter place, the upper quarry, situated near the middle of the declivity, is particularly instructive, exhibiting wide fissures and caverns, entirely filled with the alluvial loam that covers the whole country to a great extent. Considerable masses of stalactite appear in several places; and here, principally, were found those bones of large land quadrupeds now in my collection. They were met with at the depth of 20 feet, embedded in the loam of one of the wider cavities." (The bones here found, consist of those of the rhinoceros, the hare, rabbit, horse, ox, deer, hyæna, owl, and other birds, and of the lion, or tiger). "All these bones are more or less changed, and penetrated with calcareous matter. The condition of the greater part is nearly the same as that of the bones found at Gaylenreuth, Scharzfeld, &c.; and hence, it seems probable that they are of an equal age, and referable to the same epoch of the ancient world.

"Turning now our attention to the north-west side of the Elster, to the heights above Kaschwitz, we find the gypsum there *embedded in the lime-stone*, and appearing in the declivity. The former seems to have been laid bare by the destruction of the superincumbent lime-stone.

"The gypsum seems to constitute, in this neighbourhood, a large isolated mass, included in the lime-stone. As far as it is exposed in the quarries, which have no where penetrated deeper than 30 or 40 feet from the surface, it is composed of so firm a consistency as to require to be blasted with gunpowder. It is sometimes striped, in the ribbon and undulating manner, and alternating with slight layers of clay."

We are here strongly reminded of the same undulating and alternating character and appearance, in the sections of our own chalk coasts, where the *superincumbent diluvial gravel mixes with the upper surface of the chalk*, clearly denoting the latter to have been soft and movable on the surface; and the two masses to have been mixed up in the undulating and contorted form of *marbled paper* by the action of a retiring and shallow, but violently ruffled sea.

"The entire gypseous mass is intersected, and perforated by fissures and cavities, which follow every direction, and are connected with each other by serpentine channels of larger or smaller dimensions. They are filled throughout with the alluvial (diluvial) deposits, even to the greatest depth; and this loamy sediment appears horizontally disposed, for short distances, yielding *in clusters*, as it were, and in precisely the same circumstances, a number of bones of land animals, *amongst which are disclosed to observation also human bones.*

"Even from the first opening of the quarries, 30 years ago, the bones of *man, and other animals*, have there been met with. According to the unanimous relation of the workmen, the former have usually been found at a depth of from 16 to 30 feet from the surface, and this has happened in almost every quarry that has hitherto been opened in the gypsum. The cases are *rare* in which human bones, and those of other animals, have appeared singly near the surface of the gypsum, and adjacent to the vegetable soil. These have undergone a much greater change; they are more penetrated with calcareous matter, and are heavier than the bones met with at a greater depth. Our own experience confirmed the affirmation of the workmen, that various bones are always found together, *assembled in a heap*, as it were, in the loamy deposit."

What a complete picture is here presented to us of the effects of *the tide* on movable animal remains, by which a species of *regular derangement*, if I may use the term, is, at all times, exhibited on our coasts, though on a scale so small as merely to suffice as an indication of what would happen under such circumstances as must naturally have presented themselves on the sinking of the diluvial waters!*

"On visiting Cornmann's gypsum quarry, we discovered, in a nearly vertical fissure, at the depth of 16 or 18 feet from the surface, a number of bones, belonging to quadrupeds and birds, firmly embedded in the loam; though, in a disjointed state they appeared referable to skeletons that were formerly more or less complete. The idea has been advanced, that the bones of the smaller animals might have been brought there by owls, foxes, or other animals of prey; being, however, found in cavities, *but invariably enveloped in loam*, under the same circumstances as the other bones, this supposition seems invalid, and it is besides contradicted by the appearance of the bones themselves.

"It is also evident that the human bones could never have been buried here, *nor have fallen into the fissures* in the gypsum during battles in ancient times; nor have been thus

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* It is on the same small scale, but abundantly sufficiently for our purpose, that we are taught, on our present sea shores, the great and important principle on which stratification, at all times, takes place. On examining minutely a portion of fine sea-sand, fresh from the shore, we find it composed of a mixture of various crystallized particles, probably the effects of the decomposition of primitive rocks. But amongst these crystals, we generally find a variety of small black grains; and, on inspection, these black bodies are often found to be portions of vegetable matter, probably decayed sea-weed, in a very reduced state. Now, these two descriptions of matter have a very different degree of specific gravity; and when both are submitted to the action of the waves, they are consequently disposed of in a different manner. We have frequent opportunities of seeing the two disposed, in regular strata, of the most minute and beautiful form, in the heaps of sand left by the tide after a gale, about the very limits of high water mark. Those heaps, when dry, crumble, or fall to pieces; and in the miniature cliffs, presenting a section of the whole heap, we there find exactly the same beautiful stratification, that is so often exhibited in the free-stone quarries of our upper strata.

mutilated, and lodged by any other accidental cause in more modern times; inasmuch as they are always found with the other animal remains under the same relations, not constituting connected skeletons, but collected in various groups in the deposits of loam that occupy the fissures and cavities of the gypsum: they appear, therefore, to have been strictly *fossil*, and to have been swept hither by floods, with the other animal remains, at the period of the formation of the alluvial (diluvial) tract itself. It has already been remarked by Cuvier, (in his Recherches, &c. vol. i. p. 66,) that the epoch of A *great deluge*, by which many animals were destroyed, whose remains are now found *in alluvial tracts* ALONE, and not in any strata of an earlier era, nearly coincides with our chronology; and the traditions of such a deluge, preserved among all nations, *now* appears further *confirmed* by the instructive documents at present lying before us."

The following are the human bones hitherto found, (that is, up to 1820,) in these gypsum quarries near Köstritz, and which were almost all then in the collection of the Baron Von Schlotheim.

"A perfectly preserved *human forehead*, extending to one half the orbits of the eyes.* The upper maxillæ, with the teeth, mostly all preserved; the left humerus; the right and left ossa femoris. The right thigh-bone is in a more altered state than any of the other bones, being found, according to the statement of the workmen, near the out-crop of the fissure. Besides these, some other fragments of human bones are contained in collections in Gera, and in that of the Natural History Society at Altenburg. All these bones are of a rather large, but, by no means, *unusual size*, and certainly not gigantic, as stated by loose report."

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* There is, in the description of this fossil, a singular coincidence between it and one of the same character now in my possession, which was found by Captain Martin, in the Rock of Gibraltar. It was accompanied with masses of other bones, embedded in the breccia, common to that place. One of these bones has since been recognized by Mr. Clift as that of a ruminating animal; and I have ascertained by comparison, that it is the lower part of the shin-bone of an ox. This discovery had thrown a shade of doubt upon the impression of the human forehead, discovered along with it. But I now have no sort of doubt of its being the actual impression of part of an antediluvian human being. The forehead is well defined, and the half of the orbits of the eyes so distinct, as perfectly to correspond with an ancient (though, comparatively, recent) head of a mummy also in my possession.

The baron then proceeds to give a detail of the various other bones of animals found in the same situation; and, in a subsequent work, also translated, he observes, that "some of the bones have lost their animal gluten, and are even penetrated with gypsum,* while others are only slightly calcined and decomposed. This varying condition of the bones is likewise observed in all the other fossil bones of Köstritz. Of the animal remains generally admitted to have belonged to the inhabitants of the ancient world, the most numerous met with are those of the rhinoceros, although, upon the whole, they are of rare occurrence. Of the mastodon, or other gigantic animals, no remains have hitherto been found in that vicinity."

Amongst the other details of the fossil bones abovementioned, two perfect phalanges of the rhinoceros are described, found at the depth *of* 18 *feet from the surface.* "These pieces," says the baron, "are particularly deserving of notice, as *beneath them*, at the depth of eight feet further, were found fragments of the thigh and arm-bone of the *human race.*"

"From the whole of the facts now detailed, therefore," concludes he, "*it is quite evident*, that in the cavities near Köstritz, HUMAN BONES *are found intermingled, without order, with the bones of animals of the ancient world.*"

"Such bones, and skeletons, have also been found *in other places*, within the tract of the alluvial (diluvial) formations, in the vicinity of the repositories of large land animals of the ancient world, but which have not yet received that attention which they so well deserve."

It is not my purpose, in this place, to enter into, or to attempt to confute the extraordinary arguments advanced by the baron himself, in the first instance, and, subsequently, by his translator, Mr. Weaver, for the purpose of bending these "stubborn facts" to suit the prevailing theories of the great geologists of that day. It ought fully to suffice for the purposes I have now in view, to have laid the facts themselves before the unbiassed judgment of my readers; and it must, I presume, be self-evident to every one whose mind is not warped by prejudice, or fully occupied by previous theory, that if the bones from the Hymalaya glaciers, *filled with the*

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* These gypseous bones are in exactly the same state as those now in the museum of the College of Surgeons, which fell from the regions of *perpetual snow*, on the tops of the Hymalaya range, and which have already been described.

purest gypsum, and belonging to the *horse* and *deer* tribe of the present existing species, are to be looked upon as true antediluvian fossils; and if the bones, found in the basins of Paris, *in the very same substance*, are also to be looked upon in the same light; we cannot have the smallest hesitation upon the character of the diluvial deposits, containing mingled *human and rhinoceros bones*, the account of which we have just perused. I cannot, however, suffer these details to go before my readers, without presenting them, at the same time, with the opinion respecting them, of the great asserter *of the truth of the Mosaic deluge.* I imagine, that it will scarcely be credited, without a reference to one of the most popular works of that very talented writer, into what difficulties and contradictions even the most philosophic minds are led, in the attempt to reconcile *error* with *truth.*

"In one quarry," says the author of Reliquiæ Diluvianæ, "the human bones were found eight feet below those of the rhinoceros, and twenty-six below the surface. It is *highly probable*, from the admixture of the bones of so many species of *recent* animals,* with the human remains in the gypsum quarries, that both these are of *later origin* than those in the lime-stone; they appear, I think, to have been introduced, at a subsequent period, into the diluvial loam, which had *before* contained *the more ancient bones and pebbles; but by what means*, or at what precise *period* of the post-diluvian era, remains," (and ever must remain,) "yet to be ascertained."—*Reliq. Diluv.* p. 168.

We here find this distinct and unequivocal instance of *human fossil remains*, (such as has been admitted to be *alone* wanting for the corroboration of the Scripture narrative of the deluge,) completely neutralized, by what Dr. Buckland calls a *high probability*, though he gives us not the slightest reason for the grounds of his scepticism. And yet we cannot but be forcibly struck with the *hesitation* and doubt with which the *thoughts* of the learned professor, respecting this fossil deposit, are expressed. The above passage is not written in that style of decided conviction in which he so beautifully expresses himself, when his geological views, however erroneous, are completely satisfactory to his own mind. We find no such hesitation with respect to the hyænas of Kirkdale, *although their remains were also accompanied by such* RECENT *animals as the fox, the weasel, the horse, the fallow deer, the ox, the* HARE, *the* RABBIT, *the mouse, and the water rat.*[*]

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* Does the learned professor mean to imply, by recent animals, that birds, of the species of the cock, (the bones and spur of one of which were found at Kostritz,) the hare, the rabbit, or the owl, were all creations subsequent to the flood? Or to deny, that such animals could have, by possibility, existed contemporaneously, with the elephant, the rhinoceros, the horse, or the hyæna, as they do in the present day, though in the climates and latitudes best fitted to each species respectively?

The remains of all these animals, and of many more, that might, with equal reason, be termed *recent*, were found at Kirkdale, and in other diluvial deposits, accompanied by those of elephants, lions, rhinoceri, &c., *about which no doubt has ever been expressed:* and yet, in the instance of Köstritz, the rhinoceros is to be looked upon as ancient and antediluvian, while the *hare*, the *rabbit*, the *owl*, the *cock*, and *the man*, are all to be considered post-diluvian; although, it "yet remains to be ascertained, by what means, or at what period," the remains of the two eras became mixed up together.

I have but one remark further to make upon the opinions professed, and the geological doctrines taught by the able author I have just quoted; and I do so, with a repetition of my former sincere profession of my highest respect for him as a public character, though I totally differ with him in the whole view he has taken of the Mosaic deluge. But I can, by no means, perceive the principle upon which he is so constantly and strenuously opposed to the occupation of some parts of the antediluvian world by the human race: for the disbelief, even in the *probability* of their remains ever being found,[†] amounts, in fact, to at least a doubt of their having *existed* at the same time as the animals, whose bones he admits to have belonged to that ancient period.

If they then existed, they must have perished with the other animals by the waters; if they perished, their bodies *must have floated*, and been submitted to the very same laws of tides and of currents, by which other animal bodies were scattered and dispersed over the bed of the sea, in every direction.

If they were so scattered and mixed up, (and it could not *possibly* be otherwise,) we can imagine no reason, why we should not find them, as we do other diluvial remains, only in that small numerical proportion, which, we are assured, they must have borne, if the history of Scripture is to be depended upon. That we may place implicit confidence in the information conveyed to us from this Inspired source, we have found many convincing proofs in the whole course of this general treatise; and we can, therefore, have no conceivable plea, short of a distinct desire to prove it *wrong*, for strenuously opposing the evidence of numerous facts, on the subject of the fossil remains of our own species.

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[*] Reliq. Diluv. p. 17, 18.

[†] Reliq. Diluv. p. 169, 170.

It may, perhaps, here be expected, that some consistent and natural mode should be shown of the *origin* and *cause* of these remarkable caves and fissures, which, in so many instances, characterize the lime-stone formations, and intersect them in every direction. I should be sorry to involve either my readers, or myself, in the difficulties which this part of the subject might very possibly lead to. It has, hitherto, been too much the custom for science to endeavour, *by some means or other*, to account for *every individual phenomenon* presented to the view on the surface of the earth. By such injudicious attempts, many able men have led themselves into contradictions, beyond which they could not advance, and from which it was difficult to retrograde; and it is to be feared, that many of the errors of our geological theories have arisen from this mistaken course. Upon this subject of cavernous lime-stone, therefore, I do not hazard more than a passing opinion, confining myself to the facts which all such cavities invariably exhibit, and leaving this branch of the subject open to the more extended researches of future observations.

If it be true, as the Inspired Writings inform us, and as every appearance on the face of the present dry lands corroborates, that the "*earth that* NOW IS," is different from the "*earth that* THEN WAS;" and if my idea of the probable means by which the deluge was effected, is founded in reason, viz. that either the former dry lands *sunk*, or that the bed of the former sea *was elevated*, (in either of which cases the *effects* would be the same;) if these premises be well founded, it must naturally follow, that the lands we now inhabit, formed, before the deluge, the bed of the ancient ocean. If this be true, and that many of the secondary calcareous formations, which now *almost every where* cover the surface of the continents, were the result of gradual marine deposits, embedding *sea shells* in vast abundance, *but no where containing remains of* QUADRUPEDS, *or other* LAND

PRODUCTIONS, we must conclude, that on the subsiding of the ocean, (or, as we term it, the *diluvial waters*,) into its new bed, the lands that were then, for the first time, left above the level of the sea, must have been in a soft and saturated state, and containing abundance of that marine fluidity, in the midst of which they had gradually been formed. We have already found, in the instance of that most extensive formation, *the chalk*, containing, as it every where does, positive and invariable marks of *marine origin*, *without any indication of a single land production*, that upon its moist and still movable *surface*, the retiring waves had produced a partial mixture between it and the diluvial gravels and soils, containing the remains of elephants, and other quadrupeds, besides vegetable substances in great abundance, (as on the coasts of Kent and Norfolk). Had it been the nature of chalk to crack and divide itself into such cavities and fissures, as we find in some other calcareous deposits, it is very certain that we should have found these cavities furnished, more or less, with those gravels, or loams, containing the remains of organic bodies. This is not frequently the case in the chalk, because it is not part of the nature of this formation to be *cavous;* but we have, even in the chalk, certain cavities also filled with diluvial gravel, of the origin of which it would be very difficult to give even a plausible conjecture. I allude to those well-like cavities so often seen in the chalk pits near London, and also frequently found in the sections of the French and English sea coasts.* We have, also, in the chalk an insuperable difficulty, in accounting for the regular cavities in which flint nodules have subsequently been formed. I say *subsequently*, because this fact is demonstrably certain, from the fossil shells, of the chalk formation, often *embedded in the flints, as in the purest water.*[*]

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* These remarkable cavities, in the form of regular wells, of various depths, and, occasionally, of irregular forms, are exhibited in a remarkable manner in the chalk pits at Greenhithe, on the south bank of the Thames, between Dartford and Gravesend. There is, indeed, nothing more interesting, or instructive, in the geology of England, than the obviously diluvial origin of the superincumbent strata, upon the chalk, every where near London, where the wants of man, and the laws of nature, have, in so many places, combined to lay the whole formations completely open to our inspection. The almost invariably horizontal surface of the chalk, with the very marked irregularity of the new diluvial surface in the neighbourhood of [illegible]reenwich, Woolwich, Shooter's Hill, and all over that part of Kent, as well as on the northern shores of the Thames, must serve to explain this branch of our subject in the clearest and most obvious manner.

If we find ourselves in difficulty, with respect to these minor cavities, *which must have occurred under the level of the sea*, much more shall we despair of plausibly accounting for the more extensive and even stupendous grottoes peculiar to other marine deposits, as palpably having formed a part of the bed of the antediluvian ocean. One thing, however, is a well established fact, that there is an intimate and constant connection between the latest sediments of the waters of the deluge, with their animal and vegetable contents, and these upper calcareous formations. In the instance of the gypsum of the basin of Paris, the organic remains are not contained in *cavities*, but are completely incorporated in the body of a rock, so hard as to require to be blasted with gunpowder. Here is a positive proof that gypsum is a chemical deposit or formation, which was once in a *fluid state;* and we can have no hesitation with respect to the period at which this fluidity existed, illustrated, as the point is, by the identity of some of its fossils, with those of the superincumbent diluvial soils. If, therefore, gypsum was a *fluid*, at the period of the deluge, in the basin of Paris we have the strongest reasons for coming to a similar conclusion, wherever that calcareous rock is found to exist. At Köstritz, the gypsum is split into fissures, often filled, as they naturally would be, with the superincumbent gravel under which it is found. But the animal remains are of the very same description in the gypsum at both places, and the bones are in the same state of decay or preservation. We, therefore, have a right to conclude, that as the Paris gypsum was a diluvial formation, the bones, contained in it, could be no other than those of antediluvian animals. We must judge of the Köstritz gypsum by the very same law; there can, therefore, be no hesitation in considering the *human bones* of those quarries, as well as those of the *domestic cock*, and the *rhinoceros* which accompany them, *as indisputable remains of the ancient world.* The nature of all lime-stone cavities appears to be nearly the same in all countries. We hear of the bones of elephants in *New Holland*,* as well as in *America*, and in *Europe*, contained in similar caverns; and as we know of no other calamity so destructive as the Mosaic deluge, either from history, tradition, or animal remains, *we must conclude that every* LAND *production*, (together with such marine shells as often accompany them,) when found in our rocks and soils, is attributable to the action of the Mosaic deluge, and to that period alone.

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[*] I have formerly had occasion to make some remarks upon the fossil shells of the chalk formation, often found attached to, or filled by, pure flint. I have lately seen one of these fossil specimens, which has been cut through, and polished by a lapidary. The polish given to the flint is of the finest kind; and in looking into the transparent mass, we find many of the small spines, with which the shell was originally covered on its exterior surface, perfectly preserved, and lying in various directions, as if preserved in ice. No proof can be more distinct, that the flint was once in the state of a perfect fluid; and that this fluid state was subsequent to the deposit of the chalky mass, may be looked upon as equally certain. The cause of the irregular, though stratified cavities, in which flint nodules have been subsequently formed, must ever remain, however, a matter of conjecture; although, the obscurity of the cause does not, in any degree, affect the truth of the facts presented to our contemplation.

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* Specimens of fossil bones and wood were sent home by Mr. Crawford from the district of Ava, in latitude 21 degrees north. Amongst these bones were found those of two new species of the mastodon, together with the bones of the hippopotamus, rhinoceros, antelope, deer, the ox, the hog, the tortoise, and the alligator.

From the instances, few as they are, with which we are already acquainted, of such fossil deposits, in tropical, as well as in temperate and polar regions, we can have no doubt of the general and indiscriminate dispersion of animal bodies over every region of the earth; and that if the wants of man, in Asia, and in Africa, required such extensive operations under the surface of the ground, as have brought to light so many fossil treasures in Europe, and in America, we should often there discover the remains of animals as unnatural to hot climates, as the elephant and alligator are to cold ones.

CHAPTER XIV.

On the Situation of Paradise; together with both Critical and Geological Evidences of the spurious Character of that descriptive account of it, found in all Modern Copies and Translations of the Book of Genesis.

As the chief object of this treatise has been to show, from the evidence of history, corroborated by physical facts, that the greater part of the present dry lands of the earth formed the bed of the antediluvian sea, and that the former lands were utterly destroyed at the period of the deluge, "*the earth, that now is,*" being thus distinct from "*the earth, that then was,*"* a question respecting the situation of the Paradise in which our first parents were placed by their Creator, has probably arisen in the mind of every one; and but for the interruption to the general course of the subject which this question must have given rise to, it should undoubtedly have been considered at an earlier period of this work; as there is, perhaps, no part of the Old Testament, as found in our translations, which has been so fruitful a source of error and misconception, as the descriptive account of the rivers of Paradise. These rivers are described as being four in number, of which the only one at present known is the Euphrates. The names of the other rivers, and the extraordinary and inconsistent geographical account of their supposed courses, have long been a source of anxious critical inquiry, as well as of local research: for almost all travellers who have visited the East, and had an opportunity of becoming acquainted with the course of the Euphrates, have anxiously sought for the situation of Paradise; and have, invariably, been obliged to relinquish the subject, from the utter impossibility of applying the description, in the slightest degree, to any part of the course of that noble river.

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* 2d Epistle of Peter, iii. 6.

Mr. Granville Penn, in his "Comparative Estimate of the Mineral and Mosaical Geologies," has entered, at considerable length, and with his usual ability, into a critical examination of this subject; and has most clearly shown the high *probability*, amounting almost to *certainty*, of the *descriptive part* of the Garden of Eden, as found in all modern translations of the original text, having been originally annexed, *as an explanatory note, to the margin of an early MS.* and having been, *subsequently*, incorporated into the body of the work, by the ignorance of a subsequent transcriber, as has also occurred in some other parts of the Sacred Writings.

In support of this opinion, he shows, on the authority of the most learned critics, both ancient and modern, that copies of the Hebrew Scriptures formerly existed, which exhibited variations, arising from marginal glosses and insertions, originally designed as illustrations of the text, but which illustrative glosses had become, in some instances, incorporated into the text in subsequent copies.

One remarkable example, given by this able writer, of an incorporated gloss in the New Testament, and which is not so generally known as it deserves to be, is well adapted to show the nature of similar incorporations, and of the serious mischief to which they invariably lead; for *truth* is, in all instances, so consistent and simple, that any deviation from the plain tenor of its course, must, generally, excite observation, as the following remarkable instance has frequently done. This example is found in the remnant of a very ancient Greek MS. of the New Testament, in the Royal Library at Paris, entitled the *Codex Ephremi*, which has been pronounced, by Wetstein, to be of the same date as the celebrated Alexandrian MS. In this work, the first five verses of the 5th chapter of St. John's Gospel are thus read:

After this, there was a feast of the Jews, and Jesus went up to Jerusalem. Now there is at Jerusalem, by the sheep-market, a bath, which is called in the Hebrew tongue Bethesda, having five porches; in these lay a great number of impotent folk, of blind, halt, withered;* and a certain man was there,† which had an infirmity thirty and eight years. When Jesus saw him, &c.

* For an angel went down at a certain season into the bath, and troubled the waters: whosoever, then, after the troubling of the waters, first stepped in, was made whole of whatsoever disease he had.

† Waiting for the troubling of the waters.

"In the MS. in question," says Mr. Penn, "the text, and the marginal sentences, though both are in the same uncial character, are written by different hands; and it is evident, from the language, and from an itacism, perceptible in the latter, that they are of a date *posterior* to the former. It is equally manifest, that they were marginal notes, annexed with the design of illustrating the popular superstition, under which the infirm man was waiting at the bath: but, at the same time, *they adopt the superstition, and aver it to be true.* The original text was free from that blemish; and the simplicity and close sequence of the recital, bear internal evidence that these marginal passages are alien to it. The superstitious clause, therefore, does not pertain to the evangelical historian, but has become incorporated into his history in the progress of transcription."

Although the passage we are now to consider in the second chapter of Genesis, in which the descriptive account of the situation of Paradise is found, has not the advantage of so clear and distinct an evidence of its spurious character, as that of St. John above mentioned, yet there does appear, in the narration itself, the strongest internal evidence of the 11th, 12th, 13th, and 14th verses of that chapter, having been, *subsequently*, inserted into the original text, in a manner precisely similar, from a marginal note, intended, by some ignorant transcriber, as an *illustration* of the subject. When we add to this internal *critical evidence*, the remarkable *geological proofs* of the correctness of this view of the subject, the mind becomes fully confirmed in this opinion; and this, the only part of the Inspired Writings which stood in contradiction to the geology exhibited in the rest, becomes at once both consistent and clear.

It appears, therefore, nearly certain, that the text and gloss originally stood thus, as Mr. Penn has most ably shown:—

Now the Lord God had planted a garden in Eden from the first; and there He put the man whom He had formed; and out of the ground the Lord God had made to grow every tree that is pleasant to the sight and good for food: the tree of life, also, in the midst of the garden, and the tree of knowledge of good and evil. And a river went out of Eden, for (or after) watering the garden, but thence (above) it was parted, and divided into four heads (or sources).* And the Lord God took the man, and put him into the garden of Eden, to dress it, and to keep it, &c. &c.

*The name of the first is *Pison:* that is it which compasseth the whole land of Havilah, where there is gold; and the gold of that land is good; and there is bdellium, and the onyx stone: and the name of the second is *Gishon:* the same is it that encompasseth the whole land of Ethiopia: and the name of the third is *Hiddekel:* that is it which goeth in front of Assyria; and the fourth river is *Euphrates.*

"That the illustration, intended by the gloss, is unskilful, and does not answer to the *text*, is manifest; for the text mentions *only one river*, whereas, the gloss undertakes to describe *four rivers*.

"Michaelis shows, that the original word, translated *heads*, denotes *sources*, in the Syriac and Arabic languages; and he expressly states, that it never signifies the *branches of a river* in the Oriental tongues. Thus, the final confluence of four contributary streams, from the *four sources* or *heads*, to which the historian traces them in Eden, produced *one river*, discharging itself *out of Eden*, of which he speaks; which four heads, therefore, can have no relation to the *four rivers* recited by the scholiast in the gloss; because, no river separates itself into different rivers downwards; on the contrary, it is the nature of all rivers to *grow* by confluence."

Mr. Granville Penn proceeds thus:—"Most certainly," observes Kennicott, "the closest attention should be paid, in biblical investigations, to all such mistakes as introduce *confusion* and *contradiction*. Neither of these could have obtained *originally*; and both of them have frequently been objected by the advocates of infidelity."

"But," adds Mr. Penn, "the case before us exhibits a signal example of that contradiction; and, therefore, of the *obvious necessity* of demanding, and therefore warranting, the critical interposition which has here been undertaken! For the destruction of the primitive earth is a fact rooted in the very substance of the Sacred Scriptures, and spreading its roots from the text of Moses to that of St. Peter; whereas, the *contradiction of that fact*, contained in the above geographical gloss, lies loosely and unrooted on the surface, and only on this particular point of it. Since, then, a manifest contradiction of the *former* is produced by the presence of the *latter*; and since the one must, of necessity, give place to the other, it is unquestionably the office and the duty of sound and scrupulous criticism, to demonstrate the invalidity of the latter, in order that the important testimony of the former may stand unimpaired."*

Having now viewed this part of our subject critically, we may proceed to the geological proofs above alluded to, which proofs, being altogether unknown to Mr. Penn, at the time his valuable work was written, the judgment he has above given becomes of the greater value. Since the period of his publication, we have had the advantage of perusing the descriptive sketches of an intelligent traveller in the East, whose remarks, as far as they relate to our present subject, are of the greater consequence, from the circumstance of their having been written without any *theory* in view, without any geological knowledge, or the smallest desire of supporting or opposing any particular question.

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* Comp. Estim. vol. ii. p. 242.

The traveller I allude to is Mr. Buckingham, who, in the year 1816, accompanied one of the caravans which cross the Syrian desert from Aleppo to Mousul, on the Tigris, from whence he proceeded to Bagdad, on his way to India. He thus had an opportunity of passing through the region of Mesopotamia, which is bounded by the two great rivers, the Euphrates and the Tigris; and by a route across the deserts of that country, which had not been passed by any European writer during nearly a century.

I shall now proceed to give a few extracts from Mr. Buckingham's work, which must throw the most important light upon the subject of our present inquiry; and as the nature of the soil over which he passed is mentioned merely in a casual manner, and is altogether unconnected with the chief objects he had in view, there can be no just cause for hesitation or doubt as to the correctness of the statement.

He first came upon the river Euphrates, at Beer, where he crossed it, and where he considered its breadth to be about that of the Thames, in London.

"Its greatest depth did not seem to be more than ten or twelve feet. Its waters were of a dull yellowish colour, and were quite as turbid as those of the Nile; though, as I thought, much inferior to them in sweetness of taste. The earth with which it is discoloured, is much heavier, as it quickly subsided, and left a sediment in the bottom of the cup, even while drinking; whereas, the waters of the Nile, from the lightness of the mould, may be drank without perceiving such deposit, if done immediately on being taken from the river."

"The town of Beer, which is the Birtha of antiquity, is seated on the east bank of the Euphrates. The river is here about the general breadth of the Nile, below the first cataract to the sea, and is at least equal to the Thames at Blackfriars bridge. The people of Beer are, in general, aware of the celebrity of their stream; and think it is the largest in the world. It still preserves its ancient name, with little corruption, being called by them *Shat-el-Fraat*, or the River of Fraat. It is known, also, as one of the four rivers of Paradise; *and the only one, seemingly, which has preserved its name.* The river Gihon, which is mentioned, also, in the Koran, was thought, by an Indian pilgrim of our party, *to be the Gunga of the Hindoos;* and the rest assented to its being *in the innermost India.* It is true, that it is said to compass the whole land of Ethiopia; but Herodotus speaks of Indian Ethiopians in his time; and, among early writers, the word Ethiopia was applied to the country of the black people generally."

We have here another instance of the error and inconsistency which is evident in the descriptive clause respecting the rivers of Paradise. The whole geography of the Euphrates is now well known, and that it runs into the Persian Gulf, after being, like all other rivers, *enlarged* by many additions, of which the Tigris is the most considerable. It is, therefore, both *unnatural* that it should divide *into large rivers, of various diverging courses;* and, contrary to *fact*, that any part of it compasseth the whole land of either Indian or African Ethiopia.

But this idea of Mr. Buckingham, respecting INDIAN *Ethiopia*, appears entirely without foundation, in as far at least as Scripture is concerned.

Mention is very frequently made of Ethiopia, and of the Ethiopians, in various parts of the Old Testament, both in the historical and in the poetic books; but in no one instance does the term imply any allusion *to India, or to the East.* On the contrary, *Egypt*, and *Ethiopia*, are almost always mentioned together, as forming parts of the same great African continent.*

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* A few instances from the Old Testament, in order to show this close connection, may here be of use.

"Now it came to pass, in the days of Ahasuerus (this is Ahasuerus which reigned from India, even unto Ethiopia, over 127 provinces;") &c.—Esther i. 1. also viii. 9. that is, from east to west, or from the most distant parts of *Asia*, even unto the interior of *Africa*.

"For I am the Lord thy God, the Holy one of Israel, thy Saviour; I gave Egypt for thy ransom, Ethiopia and Seba for thee."—Isaiah xliii. 3.

"Thus saith the Lord, the labour of Egypt, and the merchandise of Ethiopia, &c. shall come unto thee."—Isaiah xlv. 14.

"Philistia, and Tyre, with Ethiopia."—Psalm. lxxxii. 4.

"Moreover, the Lord stirred up against Jehoran, the spirit of the Philistines, and of the Arabians, that were near the Ethiopians."—Chron. xxi. 16; that is, the Red Sea only dividing them.

Salust, in his Jugurthine war, gives us a very luminous view of the geography of Africa, and of its various nations, as far as both were known in his day; and he places Ethiopia next to "*loca exusta solis ardoribus*," or the countries burnt up by the heat of the torrid zone. This same valuable historian, in a fragment which has been preserved, tells us, "that the Moors, a vain and faithless people, as all Africans are, would make us believe, that, beyond Ethiopia, there is an *antipodes*, a just and amiable people, the manners and customs of which resemble those of the Persians."

We shall have occasion, in the next chapter, to notice some customs amongst the Africans of the interior, which are evidently derived from their Asiatic progenitors.

"The banks of the river, at Beer, are steep on both sides, *and of a* CHALKY SOIL." "There are many *perpendicular cliffs within and around it*, in different directions; in these *are many large caves, and smaller grottoes.* They are of *a hard* CHALKY *substance*, and the cavities have furnished the materials for the building of the town.* The whole presents *a mass of glaring white*, which is painful to look upon in the sun."

After leaving Beer, and on his way to Orfah, over *a very flat and desert country.* Mr. Buckingham proceeds; "we were now come into a more uneven country than before; the height of many of the eminences gave them the character of hills; and they were, throughout, formed of lime-stone rock, of a rounded surface, and, generally, barren. In the valleys were some few patches of cultivated ground, but the rest was covered with a long wild grass." We have here, again, on these extensive plains, all the outward form and charac-

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"Ethiopia and Egypt were her strength, and it was infinite."—Nahum iii. 8 and 9.

Moses, also, when residing in Egypt, had married an Ethiopian woman.

"He shall have power over the treasures of gold and of silver, and over all the precious things of Egypt; and the Libyans and the Ethiopians shall be at his steps."—Daniel xi. 42; see also the whole of the 20th chapter of Isaiah. Besides these, many distinct instances might be quoted, to show that Ethiopia is never alluded to in Scripture, but with reference to a province of Africa; and, consequently, that there could be no possible connection between any branch of the Euphrates and that distant country.

* It is highly probable, from the nature of the secondary rock above described, that these "large caves and smaller grottoes" were such natural cavities as are peculiar to some calcareous formations.

ter of that *chalky* formation, exposed to view in the channel of the Euphrates, at Beer.

On arriving at Orfah, we find a repetition of the above *secondary indications*, in the following extract. In the course of a walk round the outside wall of the city, Mr. Buckingham remarked, in the construction of the wall, three distinct periods of very ancient building. The foundation was evidently *of an extremely remote period.* "The surface of the blocks of stone," says he, "was, in general, much corroded by the action of the air; and, on a close examination, I was surprised to find them mostly blocks of coral and sea shells, such as are seen *in the cliffs* along the shores of the Red Sea, in a state of decay. In some of these, the substance seemed to be a *mass of lime*, in a state of decomposition, which crumbled at the touch, into a white salt-like powder. In others, the large oyster, with the small queen, or fan shell, was repeatedly and distinctly seen, with still more numerous examples of those smaller ones, like ram's horns, so frequent among the sands of every sea-beach. Other parts, the surfaces of which had become hardened by the action of the air, looked like coarse lime-stone, crossed by harder and finer veins of pure marble. These stones were all in the original structure of the wall, though, of what age, it would be difficult to determine. But the nature of the stone is well worthy of remark, in a situation so remote from any sea, and so elevated above the level of the ocean, beneath which, alone, it could have been formed. I had seen no such rocks in the way to Orfah; though no doubt the quarries from which the stones were taken, are not far remote; but, in the neighbourhood of Aleppo, there are several masses of hardened shells and coral, appearing above the surface of the ground."

We find a similar instance of secondary formation mentioned by Xenophon, in his Anabasis, iii. p. 212, who describes, in the following terms, a very large city, which the Ten Thousand passed in their famous retreat: "marching, the rest of the day, without disturbance, they came to the river Tigris, where stood a large uninhabited city, called Larissa," (probably, the *Resen*, mentioned as *a great city*, Gen. x. 12.) "anciently inhabited by the Medes, the walls of which were 25 feet broad, and 100 in height, all built of brick, except the plinth, which was built *of stones*, and 20 feet high. The plinth of the wall *was built of polished stone*, FULL OF SHELLS,[*] &c."

These very casual observations, on the Geology of Mesopotamia, serve to indicate, in a remarkable manner, the general *secondary and diluvial nature* of the whole surface of that eastern region, which is composed either of secondary rocks, or diluvial sands and soils; for the calcareous or *chalky* character of the rocks, appears evident from the distinct mention of the fossil sea shells contained in some of the few specimens to which the traveller's attention had been attracted. The object, in quoting these extracts, is not with the view of any *general* information, as to the secondary nature of a great part of Syria, and the regions east of it; as our former general view of those regions tended distinctly to prove that the whole of that part of the continent of Asia, with but few exceptions, was of that secondary character. But as the chalk formation is here described as forming a considerable part of the course of the Euphrates, *upon which the primitive Paradise is said to have existed*, the subject is thus brought, *geologically*, to a positive issue.

For if it has been satisfactorily proved, in the course of this treatise, that the chalk formation formed a part of the bed of the antediluvian ocean, and that the chalk *basins* of geologists must have become charged with their present diluvial contents at the period of the deluge, it is an inconsistency, of the most glaring kind, to look for the site of the *primitive Paradise* upon the surface of *a secondary country*, then forming the bottom of the sea, as is satisfactorily proved by the nature of its rocks, and by the marine fossils contained in them; which, like all secondary formations, in other parts of the earth, could only have become *habitable dry land*, by the interchange of level between the old lands and the ocean, at the period of the deluge.

No one can, therefore, persist in his search for Paradise, in a country avowedly *secondary* in its *rocks*, and *diluvial* in its sandy deserts, or richer soils, without advocating a theory in geology still more inconsistent and wild, than has yet been advanced; for as we can trace, over all these regions through which the Tigris and the Euphrates flow, the same monuments of the flood, which are so remarkable in every other quarter of the world, in the form of boundless deserts of sand mixed with *salt* and *shells*, we might as well look for the rich and beautiful regions of our first parents in the plains of America or of Africa, as expect to discover any trace of them *on the banks of the river Euphrates.*

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[*] The great pyramid of Cheops, in Egypt, stands, like the other pyramids of that country, in a plain, composed of calcareous rock. It is formed of lime-stone, of a grayish white colour, and which exhales a fetid odour when broken by a smart blow. Thus we find another instance, of one of the earliest edifices, of post-diluvian man, formed of a secondary rock, and standing on a secondary formation.

We thus come to the same point, *geologically*, which various writers have before reached *critically;* and we have, in this united evidence, a striking example of what must ever happen, where human *reason* interferes with the sublime and consistent simplicity of DIVINE REVELATION.

CHAPTER XV.

On the Creation of Mankind.—The Origin of Language.—What was the Primitive Language?—High Probability in favour of the Hebrew.—On the Diversity of Colour among Mankind.—Testimony of the Jews on this Subject.—Origin of the American Indians.—Their traditions and Customs.—Their Religious Belief.—Religious Rites in the Interior of Africa.—On Sacrifice.—Traditions and Belief in the Friendly Islands.—Historical Evidence of a common descent from Noah.—On the Identity of Words among the most distant Nations.—On the universal use of a Decimal *gradation.—Natural Inference from all these Considerations.*

It may, by some, be looked upon as an inconsistent and uncalled-for departure from the geological inquiries which form the main object of this treatise, to take, in this place, a rapid view of a subject so apparently unconnected with the structure and phenomena of the earth, as the *languages*, the *complexions*, the *traditions*, and the *customs* of many of the most distant nations. But when we consider, that the design of thus tracing the history of the earth, as recorded by inspiration, is to oppose those theories of philosophy which would expand the well-defined periods of the Mosaic history into *indefinite* periods, during the long lapse of which, both the mineral world, its inhabitants, and its languages, gradually became what we now find them, by the *progress of society*, in the one case, and by the *mere laws of nature* in the other, without any aid from a superior power; it may be readily admitted to be a point of no small importance, in corroboration of the correctness of the views we have taken of the earth, if we can discover, from an equally general view of the human race, and of their various languages and customs, decisive proof of the *recent* creation of man, of the still *more recent* action of the deluge, and, consequently, of the entire confidence with which we may refer to the Mosaic record, for a true account of the early events upon the earth.

The evidence which may be adduced of the general origin of all the languages of the globe, when added to the remarkable traditions of the deluge, which have already been noticed, may serve to confirm, in sceptical minds, the *unerring truth* of the sacred volume, when it announces to us, first, that all mankind have sprung from *one pair*, created on the sixth and last day of the creation; secondly, that, after upwards of sixteen hundred years of increase over a portion of the then dry land, the whole of that race perished by an awful judgment of the Almighty, excepting one single family; thirdly, that whatever the languages of the antediluvian world might have been, that single family had but *one* individual language, which was handed down by them to their descendants; and, fourthly, that from the deluge to that period in which the descendants of Noah had so far increased in number, and in wickedness, as to endeavor to elude any similar effect of the divine wrath, by building the tower of Babel, in the plains of Shinar, "the whole earth was of one language, and of one speech," which language was there "confounded," or scattered, by the will of the Almighty; so that the people were interrupted in their impious intention, and "scattered abroad," in various tribes or clans, "over the face of the whole earth."

With respect to the original language which Moses describes our first parents as making use of, from their very first creation, we are no where informed in what manner they first acquired it, nor how it was communicated to them. It is, indeed, probable that the inspired historian addressed himself to those who were much less sceptical on such subjects than ourselves; and that this remarkable endowment, peculiar to the human race, and by which they so far excel all other created beings, was never, in early times, doubted as having been directly communicated from the same wise and provident source from whence the human race itself had arisen; and the researches of the wisest and most learned men of all ages have invariably led them to the same natural conclusion.

We have no direct means of positive knowledge as to what relation the *primitive language* of the earth may have had with existing tongues; but, in the absence of such evidence, we may form some conjectures on the subject, which are certainly marked with the highest probability. In the first place, we must consider that the numbers of the antediluvian human race, and their consequent divisions into nations, could not have been nearly so great as in the present day, from the comparatively short period they had existed, and from the comparatively unrefined condition natural to a primitive race of beings, on whom the gift of reason was obviously bestowed by the Creator, for the purposes of exertion, and of gradual cultivation and improvement. We must not here suppose, however, with too many advocates of an erring philosophy, that man was, at first, naturally *savage*, or in the state we now find the wild and uncultivated natives of savage countries; or that religion and knowledge were, in the first days, in the debased condition we now too often find them, in the remote corners of the earth. *The savage state is not natural to man;* but, on the contrary, is brought on by erring from the true path of knowledge, in which both Adam and Noah must have brought up their first descendants; and which, in both instances, was communicated in a direct manner, from the unerring source of every good which mankind now enjoys. In considering the progressive stages of society, we are too apt to content ourselves with merely looking *back*, from our own times, into the darker ages of barbarism, and thus to form our ideas on the false supposition, that the primitive nature of man is one of perfect ignorance, and such as we now find amongst the savages of Africa or America: whereas, if we trace the progress of society, in its proper and natural course, by *descending from the creation, and from the deluge*, instead of *ascending* from our own times, we shall find that the primitive state of mankind, even immediately after the creation, was one of *intelligence* and *understanding*, if not in arts and sciences, at least on the leading point of religion, which is, of all others, that in which the savage falls most short of the civilized man. It pleased his Creator to bestow upon primitive man a full and perfect conception of the relation in which he stood towards the Supreme Being; and it was in order to preserve a knowledge of the true religion among men, that a certain family and race were afterwards expressly chosen; we find, accordingly, that to whatever state of idolatrous ignorance, or savage barbarity, the various ancient nations of the earth were, from time to time, reduced, there was always some portion of the world, and especially of the Jewish race, which adhered to the true faith, and which was, consequently, preserved from that state of unnatural debasement from which man has a constant tendency and desire to emancipate himself. It is, therefore, highly probable, that as we hear of no diversity of language on the earth, until after the deluge, the whole primitive race was "of one language, and of one speech," and that that language must, consequently, have been the same spoken by those few individuals who were preserved from the flood.

Now, when we consider the great scheme of the Almighty, foretold from time to time, from the days of Adam to those of Abraham, and continued from thence, in a well defined course of history, to our own times; when we consider the wonderful and miraculous events that were *foretold*, and were afterwards so literally *fulfilled*, in the line of the chosen people of God; that, through them, and through their language, the Inspired Writings of the early times, were to be for ever handed down to the generations of men; that of all the languages of the earth, the Hebrew tongue, like the Hebrew people, has hitherto withstood every change and every calamity; and been, like them, miraculously preserved by the Almighty will, for a great and beneficent end; and when we further consider the strong analogy and filiation, so easily traced, in all the languages of the earth, to the Hebrew, as the most probable *post-diluvian* original tongue; when all these considerations are combined, is it unreasonable to conclude to the high probability of the original language of the Sacred Scriptures being the pure and original tongue first communicated to man by his Maker? In considering, then, the language of the Hebrews as the most probable source from whence all other tongues have been derived; and when we trace in all these other tongues, the gradual varieties that have arisen, and are still now proceeding in the dialects of the earth, by the *secondary causes*, and, seemingly, trivial accidents, by which the different shades of language are brought about, are we not strongly reminded of the same character which we have traced in the *primitive* and *secondary* formations of the mineral world? Are we not justified in drawing a comparison between the miraculously preserved *primitive language*, and the no less miraculously preserved chosen people, who are the constant *living miracle*, bearing *unwilling witness* to the truth of Inspiration, to all the generations of mankind? We are reminded, that it was repeatedly foretold in prophecy, that the Hebrew nation should be dispersed into all countries; yet that they should not be swallowed up and lost amongst their conquerors, but should subsist, to the latest times, a distinct people; that, "though God would make an end of the nations, their oppressors, He would not make an end of them."

In the *common* course of human events, who has heard of, or seen, so unusual a thing? The mighty monarchies of Assyria, of Persia, of Greece, and of Rome, have vanished, like the shadows of the evening, or passed rapidly away, like the shining meteors of the night. Their places know them no more; nothing remains but the great *moral* of their tale. But this chosen people of God, contemned by all nations, without a friend or protector, yet secure amidst the wreck of empires, oppressed, persecuted, harassed by edicts, by executions, by murders, and by massacres, has outlived the very *ruins* of them all. Well may we exclaim, "Truly this is the Lord's doing, and, therefore, so marvellous in our eyes."

Before, however, proceeding further with the consideration of the languages of the earth, it may not be uninteresting, or uninstructive, to make a few observations on a different subject, which, like language, has given rise to much theory and hypothesis amongst men; and on which subject, the same remarkable people may assist in enlightening us. I mean, the varied *colour* of the human race.

Notwithstanding all the arguments which have been made use of, and the modified exceptions which may be produced, there is no general conclusion more certain, than that the complexions of men are influenced by the temperature of the climates they have long inhabited; and that, in common circumstances, the equatorial regions, nearest the level of the sea, are inhabited by the darkest of the human race; while the cooler temperatures of the earth, either from *atmospheric*, or *polar* elevation, produce a race of men, of various degrees of whiteness. We must not, however, estimate the degree of *heat* in any climate, merely by its distance from the equator; for the climates of the earth are most materially affected by a variety of circumstances; such as their elevation above the level of the sea; the height of the neighbouring mountains; the comparative extent of land and water, and the like. Thus, there are no native negroes in America, although the torrid zone extends across that continent. But the extent of its neighbouring oceans, its lofty mountains, in many instances covered with perpetual snow, cool the scorching breezes of the torrid zone, and convert it into a comparatively temperate climate. The inhabitants of this New World are, therefore, found to be only of a tawny, or copper-coloured complexion.

But the most remarkable instance of the effects of climate, in changing the colours of men, after a certain period, may be found in the history of the Jews; that race, which we know were once all of one colour, but which are now found dispersed among the nations, and assuming, in every clime, the varied tint of the individual people amongst whom they dwell, without, however, having one drop of blood in their veins but what has flowed in a direct line from their patriarch Abraham. In Britain, and in more northern countries, they are *fair;* in Spain, and Portugal, they are *brown;* in Arabia, and Egypt, they are *copper-coloured;* while in Abyssinia, and in India, they are almost wholly *black.*

Dr. Buchanan, in his Christian Researches, in treating of the Jews of Cochin, in India, says, "It is only necessary to look at the countenances of the black Jews, to be satisfied that their ancestors must have arrived in India many ages before those of the white Jews. Their Hindoo complexions, and their imperfect resemblance to the European Jews, indicate that they have become detached from the parent stock, many ages before those of the north and west."

Bishop Heber, in his Journal in India, makes the following just and interesting observations on this subject. "The Indians consider fairness as a part of beauty, and a proof of noble blood. They do not like to be called black, and they taunt the Abyssinians, who are sometimes met with in the country, on the charcoal complexion of the *Hubshee.* Much of this taste has, probably, arisen from their country having always been a favourite theatre for adventures from Persia, Greece, Tartary, Turkey, and Arabia: all white men, and all, in their turn, possessing themselves of wealth and power. It is remarkable, however, to observe, how surely all these classes of men, in a few generations, and without any intermarriage with the Hindoos, assume the deep olive tint, little less dark than a Negro, which seems natural to the climate. The Portuguese natives form unions among themselves alone, or, if they can, with other Europeans; yet they have, during a three hundred years residence in India, become as black as Caffres."—*Heber's Journal*, vol. i. p. 54.

It is evident, therefore, that in the many various shades which mankind are found to assume in different parts of the earth, according to the different temperatures of climate, there can be no sound argument raised against a *common origin from a parent stock*. The varied colour of mankind appears to be the effect of a mere *law of nature*, instituted, no doubt, for a beneficial purpose by the Creator, which purpose may, probably, be one day explained, like so many other obscurities in the wonders of creation.

It has been found by Dr. Franklin, that black transmits heat more readily than any other colour; and the subject has since been investigated, and confirmed, in various conclusive experiments, by Mr. Leslie, and Count Rumford. We may, therefore, reasonably conclude, that the dark colour of the human race, which is found to increase in proportion to the scorching influence of the sun, is a wise provision of the Almighty, for cooling the fever of the blood, under the intemperate rays of a tropical climate.

But to return from this digression, to the subject of language, which we were before considering.

As recorded history cannot be looked for in wild and savage nations, we can only hope to find some traces of the origin of such nations in their traditions, or in their language. In the former of these, however, we can, in general, only look for approximations to truth; as, however sound their foundation may originally have been, they generally become, in a long lapse of time, so clouded with error, and obscured by the superstition which usually accompanies the ignorance of uncivilized states, that even the early histories of the most polished nations are unsatisfactory and obscure. Much less then can we expect any defined account of the rise or progress of the nations of the New World, or in the still more distant parts of the earth. All travellers in America, however, who have taken any notice of this subject, record the tradition, common amongst many of the tribes of that continent, with regard to their originally having come from a great distance, and having been urged forward by the advance of other tribes, in much the same manner as the European states were overrun by the northern hordes towards the decline and fall of the Roman empire. But whether these American tribes were urged on, by sea or by a land communication with the Old World, towards the north, must probably now remain for ever a subject for speculation and conjecture.

It may be interesting in this place, however, to make a few remarks upon some of the customs and traditions of the Indian tribes in America, which, in many instances, tend to confirm, in the most remarkable manner, the fact of their descent from the common parent stock in the Old World, although the manner of their entering the American continent has not yet been in any degree, ascertained. A tradition is mentioned by Hunter, as common to many of the Indian tribes, that their ancestors were forced to migrate from a *north* or *north-east* direction, *towards the south.* It has already been remarked, that these Indian tribes all count their time, or days, from *sunset to sunset*, in the same manner as the Hebrews, though contrary to our established customs in Europe. Their year, also, begins with the spring, and is divided into 13 moons.* They relate, that the Great Spirit created, at first, one of each sex, and placed them on an island *in the midst of the great waters*, which, as the human race increased, was enlarged, by supernatural means, to the present extent of the earth. Their traditions respecting the general deluge have been already noticed. They are a highly moral people, and acknowledge one supreme, all-powerful, and intelligent Being, called the Great Spirit, who created and governs all things. "They believe, in general, that after the hunting grounds had been formed and supplied with game, He created the first *red man and woman*,† who were very large in their stature, *and*

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* This most natural idea of beginning the circle of the year with the Spring, is highly interesting, when found to exist in a savage country like America.

The ancients were of the same opinion, as we find from many passages in their writings; and especially in those beautiful lines in the second Georgic, where the Poet describes the effect of Spring and proceeds thus:

> Non alios prima crescentis origine mundi
> Illuxisse dies, aliumve habuisse tenorem
> Crediderim; ver illud erat, ver magnus agebat
> Orbis, et hibernis parcebant flatibus Euri,
> Cum primum lucem pecudes hausere, virumque
> Ferrea progenies duris caput extulit arvis,
> Immissæque feræ silvis, et sidera clœo.—*Geor.* 2d, 336.

† It is a circumstance not unworthy of remark in this place, that the name of our first parent Adam was bestowed upon him from the red earth, from which he sprung; Adam having this signification in the Hebrew tongue.

lived to an exceedingly old age; that He often held councils, and *smoked with them*, and gave *them laws to be observed;* but that, in consequence of *their disobedience*, He *withdrew from, and abandoned them to the vexations of the Bad Spirit*, who has since been instrumental to all their degeneracy and sufferings."—*Hunter's North America*, p. 214.

"By the term *Spirit*, the Indians have an idea of a being that can, at pleasure, *be present, and yet invisible.*"

"They have no particular *day* set apart for devotion, though they have particular *times*, such as a declaration of war, restoration of peace, the season of the harvest, and the new moons.* In general, however, a day seldom passes with the elderly Indians, or others, who are esteemed wise and good, in which a blessing is not asked, or thanks returned to the Giver of life; sometimes audibly, but most generally in the devotional language of the heart." "All their serious devotions are performed in a standing position." "On some occasions of joyous festivals, *lamps*, constructed of shells, and supplied with bear's grease, and rush wicks, *are kept burning all the preceding and following night.*" "In all the tribes I have visited, the belief of a future state of existence, and of future rewards and punishments, is prevalent."

"I have seen an instance, wherein a prophet, or priest, burnt tobacco, and the offals of the buffalo, and deer, *on a kind of altar, formed of stones, on a mound.*"†

In Lander's Journal, to explore the course of the Niger, in Africa, we find the following account of a sacrifice offered annually at Kiàma. "This is the eve of the *Behum Sàlàh*, or *Great Prayer Day*, on which day, every one here, who possesses the means, is obliged to slaughter either *a bullock* or *a sheep;* and those who may not have money sufficient to procure a *whole* one, are compelled to purchase *a portion of the latter*, at least. The Mallams make a practice of slaughtering the sheep which may have been their companion in their peregrinations for the past year; and as soon as the feast is over, they procure another to supply its place, and to undergo the same fate on the following year." After describing the religious ceremonies of the day, Mr. Lander proceeds:—"When the priest had finished, he descended from the hillock, and, with his assistants, slaughtered a sheep, *which had been bound and brought to him for sacrifice*. The blood of the animal was caught in a calabash; and the king, and the most devoted (devout) of his subjects, washed their hands in it, and sprinkled some on the ground."

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* "Blow up the trumpet in the new moon, in the time appointed, on our solemn feast day.

"For this is a statute for Israel, and a law of the God of Jacob."—Psalm lxxxi. 3, 4.

† Hunter's North America.

The very remarkable analogy between this African ceremony and the Jewish passover, and other sacred ordinances, is too striking to require comment. Amongst many other savage nations, the custom of *an offering* is so common, that a glass of water is never drank, or a morsel of food made use of, without a little of it being first thrown upon the ground, as an offering to their deity or *fetish*.

This, and many other instances of *sacrifice*, to be found in the best accounts of the American and the African savages, would be, of themselves, sufficient to prove, most distinctly, their descent, in both cases, from Adam. For it has always been admitted, that the ordinance of *sacrifice* could have, in no way, occurred to the human mind but by a direct command from the Creator, such as must have been given to our first parents themselves; and which, in the case of their two eldest children, led to the acceptance of the one, and the rejection of the other, from the presence and the absence of belief or *faith* in its efficacy. From Cain and Abel, and their descendants, we hear of a continual course of sacrifice, both in the line of the true believers, and in heathen nations, down to the times of Christianity; whence it has been carried on, in Christian countries, by the new dispensation; and, in the heathen nations, by the varied course of blind superstition, common to a state of degenerate man.

In Mr. Mariner's sketch of the Friendly Islands, we are informed, that the savage of Tonga believe in gods, or supreme beings, who have the power of dispensing good and evil to mankind, according to merit; and that there are also, evil spirits, or mischievous gods, who *torment the wicked*, as a punishment for their deeds. The respect which they pay to these imaginary beings is so great and universal that scarcely any instance is known of direct impiety, though they consider many things meritorious which we consider criminal.

Their ideas of the origin of the world are so singular, and so strong an indirect proof of their original descent, that I shall here mention them. They believe that originally, *there was no land above the waters of the sea;* but that when one of their gods, named Tangaloa, was fishing in the ocean, his hook became fixed at the bottom; he exerted his strength, and *presently there appeared, above the surface of the waters,* several points of rock, which increased in number and extent, the more he drew his line. The rocky bottom of the ocean was now fast advancing to the surface, when, unfortunately, *the line broke*, and the Tonga islands remain to show the incompleteness of the operation. The earth thus brought to the light of day, soon became replete with all kinds of plants and animals, (such as exist in an imaginary island, called Bolotoo, or the residence of the gods,) but they were of an inferior quality, and subject to decay and death. Tangaloa now sent two of his sons to dwell in Tonga, and to divide the land between them. But one of these sons was industrious, and the other idle, and envious of his brother, *whom at length he killed.* On which his father confined him, and his race, to the Tonga islands for ever, to be black in their persons, and to have bad canoes; while he sent the children of his murdered son into a distant land, to be white in their colour, as their minds were pure; to be wise and rich, and to have axes and large canoes in the greatest abundance.

That this singular tradition, in these the most remote islands of the earth, must have been handed down from their continental progenitors, clearly appears from some of their customs, which bear a close analogy to those of ancient Asia, as well as from some words in their language, which will be afterwards noticed.

At their funerals, they wound the head, and cut their flesh with knives and shells, as a testimony of respect to the memory of the dead. This is a custom which we find expressly forbidden in the 19th chapter of Leviticus, 28th verse. "Ye shall not make any cutting in your flesh for the dead, nor print any marks upon you; I am the Lord." The natives of these islands also practise *circumcision,* a custom so remarkable, that it could only have been derived from the very ancient religious rite, commanded at first to Abraham. They also offer *sacrifices* to their gods; and, as in other countries, an INNOCENT victim, such as a young child, is considered most likely to expiate sin. This sacred rite, so universal in the world, and one which unassisted reason never could have conceived, is, of itself, sufficient to show the primitive descent of these distant islanders, from the parent stock of Noah.

When we add to these remarkable customs and traditions, the conclusive evidence of the common tradition of a general deluge; and, also, the equally convincing proof to be derived from an almost identity of language in many general expressions, common to all nations; we cannot resist the conclusion to which we are led; we must admit, that *accident* alone could never have produced such remarkable identity; and, consequently, that the truth of the Mosaic record is fully established, as to the gradual descent of all the present human race, from the *one family* preserved at the deluge.

It only now remains for us, after having thus found such circumstantial evidence of a *common descent*, to consult the most authentic history on this interesting point, and we shall find the strongest reason to give up all hesitation or doubt that may have still lurked in our minds. The historian I am about to cite, is Josephus, a writer, whose works are of such importance to history in general, and to Scripture history in particular, that many have not hesitated to consider him nearly in the light of an inspired authority. Though this may be going too far, yet it must be admitted, that this remarkable man, from the uncommon circumstances in which he was placed, at a period of the Jewish history, avowedly miraculous; from his great candour, his extensive learning, and admitted probity, in the difficult situation in which he was placed, as the intimate friend of the enemy of his country, can scarcely be looked upon in the light of a common historian. When we add to these, his almost miraculous escapes from death, his prophetic dreams, and his luminous writings, preserved entire, while so many others, of that period, have been for ever lost, one can scarcely fail to be convinced that this man was raised up by the providence of God, for great and useful purposes, which no subsequent writer could be expected to accomplish, with a like authority.

This valuable historian, in taking a general view of the early history of the world after the deluge, distinctly shows the origin and names of a large proportion of the nations then known to the Romans. He was addressing this review of the early events on the earth, to an enlightened and learned people, amongst whom, as the intimate friend of the Emperor Titus, he held a high rank. He appears, in his writings against Apion and other Greek authors, who had attempted to throw a doubt upon his accounts of the early history of the Jews, to have had the most full and minute acquaintance with the whole range of Grecian and Egyptian literature, and was, therefore, by his equally intimate acquaintance with the history and traditions of the Jews themselves, perhaps the only individual that can be named, who was qualified to view the subject in a wide and unprejudiced field.

Josephus, then, in taking a general view of the early events in the post-diluvian world, distinctly shows the origin of many of the nations, then known to the Greeks by other names than they originally had; and proceeds thus:

"After this, they were dispersed abroad on account of their languages, and went out, by colonies, every where; and each colony took possession of that land which it lighted upon, and unto which God led them, both the inland and maritime countries. There were some, also, who passed over the sea in ships, and inhabited the islands; and some of these nations *do still retain the denominations which were given them by their founders;* but some have lost them also; and some have only admitted certain changes in them, that they might be the more intelligible to the inhabitants; *and they were the Greeks who became the authors of such mutations;* for when, in after ages, they grew potent, they claimed to themselves the glory of antiquity, *giving names to the nations that sounded well in Greek*, that they might be better understood among themselves; and setting agreeable forms of government over them, as if they were a people derived from themselves."—*Antiquities*, book 1st, chap. v.

Without entering more fully into the clear account given of the dispersion of mankind, in the 6th chapter of the first book of the Antiquities of the Jews, I shall here content myself with strongly recommending its perusal to the attention of any one desirous of following out this interesting subject; and with referring to the annexed genealogical scheme, which comprises the whole information given us by Josephus on this point; it will clearly show, at a glance, the outline of the first dispersion of mankind from Noah. The subsequent stages, and more minute ramifications of this vast tree, must be traced out by history, and by the customs, traditions and languages, now existing among the nations.

We may now proceed to the consideration of the identity in some parts of the languages of various nations, before alluded to; but this part of our subject has been already so ably handled by Dr. Mason Good, in his Book of Nature, that I shall not hesitate, (in adopting his views of the subject,) to present to my readers an extract from that most able work, which will place the subject before them in the clearest possible light.

"Articulate language," says that able writer, "is of two kinds, *oral* and *legible;* the one, penned, or printed, and addressed to the eye; the other, spoken, and addressed to the ear. Written language distinguishes *civilized* man from *savage* man, as speech distinguishes man in general from the brute creation. It is of so high an antiquity, that, like that of the voice, it has been supposed, by many good and wise men, in all ages, to have been a supernatural gift, communicated either at the creation, or upon some special occasion, not long afterwards; yet there seems no satisfactory ground for either of these opinions.

"That it was not communicated, like oral language, at the creation of mankind, appears highly probable, because, first, it by no means possesses the universality which, under such circumstances, we should have reason to expect, and which oral language actually displays. No tribe, or people, have ever been found without a tongue, but multitudes without a legible character; and amongst the different tribes and nations that do possess it, it is far from evincing that unity, or similarity in the structure of its elements, which may be traced in those of speech, and which must be the natural result of an origin from one common source; for the system of writing, among some nations, consists in *pictures*, or marks representative of *things;* among others, in *letters*, or marks, symbolical of *sounds;* besides, there does not seem to be the same necessity for Divine interposition in the formation of written characters, as in that of oral language; the latter existing, the former might be expected gradually to follow, in some shape or other, from that imitative, and inventive genius which belongs to man, especially in a civilized state.

"With respect to oral language, those who have most deeply studied the subject have generally come to the conclusion, that nothing short of Divine Power could have given rise to so wonderful a gift.

"Some schools of philosophy, indeed, have supposed, that man, when created, had no greater gift of tongue than is found amongst the various kinds of brutes; and that it was only by gradual steps in civilization that perfect language arose.

This is arguing upon the same principle as the strange opinions of Buffon, and others, who derive the race of man from *monkeys*, and who, in exhibiting the *ourang-outang*, have hence denominated him the *satyr*, or *man of the woods*.

"If the above opinion were admitted to be just, we should have a right to expect that the language of a people would always be commensurate with their civilization. It so happens, however, that although language, whatever be its origin, is the most difficult science in the world, (if a science it may be called,) it is one in which savages of all kinds exhibit more proficiency than in any other. No circumnavigator has ever found the inhabitants of the most distant islands deficient in this respect, even where, in every thing else, they were almost in a state of nature.

"There is, in all the languages of the earth, a general *unity of principle*, which evidently bespeaks a general *unity of origin*; a family character and likeness, that cannot possibly be the effect of *accident*. The common divisions, and rules of one language, are the common divisions and rules of the whole; and hence, every national grammar is, in a certain sense, and, to a certain extent, an *universal grammar*, and he who has learnt one foreign tongue, has imperceptibly made some progress towards a knowledge of other tongues. Diversity of language consists, not in different sets of articulations, but only in a difference in their combinations and applications. No people have ever been found so barbarous as to be without articulate sounds; and no people so refined and fastidious, as to wish to add to the common stock.

"But independently of an uniform circle of articulations, and an uniform system of grammar, there is also an uniform use of *the very same terms*, in a great variety of languages, to express the same ideas, which cannot possibly be accounted for, except upon the principle of *one common origin* and *mother tongue*. I mean, particularly, those kind of terms, which, under every change of time, and every variety of climate, or of moral or political fortune, might be most naturally expected to remain *immutable*; as, for example, those of family relationship, and patriarchal respect, or descriptive of such other ideas as cannot but have occurred very generally to the mind, as those of *earth*, *sky*, *death*, *Deity*, *&c.*"

I do not here propose following Dr. Mason Good through the whole course of his most interesting research, but shall merely select a few of the most striking examples, which must be fully sufficient for my present general purpose.

"In our own language, the term *papa*, and *father*, describe the paternal character, both are as common to the Greek language as our own, and have, probably, alike arisen from the Hebrew source; and it may fearlessly be affirmed, that there is scarcely any language or dialect in the world, polished or barbarous, continental or insular, employed by blacks or whites, in which the same idea is not expressed by the radical of the one or the other of these terms. The term *father* is still found in the *Sanscrit*, and has decended to ourselves, as well as to almost all other nations in Europe, through the medium of the Greek, Gothic, and Latin. *Papa* is still more obviously a genuine Hebrew term, and has a much wider spread over Asia, Africa, and the most barbarous islands of the Pacific, extending from Egypt to Guinea, and from Bengal to Sumatra and New Zealand.

"The terms for *son* are somewhat more numerous than those for *father*; but one or other of them may be traced almost as extensively, as may the words *brother*, *sister*, and even *daughter*, which last, branching out, like the term *father*, from the Sanscrit, extends northward as far as Scandinavia.

"The generic names for the Deity, are chiefly the three following, *Al*, or *Allah*, *Theus*, or *Deus*, and *God*. The first is Hebrew, the second Sanscrit, the third Persian; and besides these, there is scarcely a term of any kind by which the Deity is disignated in any part of the world, civilized or savage. Among the barbarians of the Philippine Islands, the word is *Allatallah*, obviously the *God of Gods*, or the *Supreme God*, and it is the very same term in Sumatra. In the former islands, we meet with the terms *malahet* for a *spirit*, which is both direct Hebrew and Arabic; *is* and *dua*, one and two, which are Sanscrit and Greek; *tambor*, *a drum*, which is also Sanscrit; and *inferno*, *hell*, a Latin compound of Pelasgic or other Oriental origin. In the Friendly, and other clusters of the Polynesian Islands, the term for *God* is *Tooa*; and in New Guinea, or Papuan, *Dewa*, both obviously from the Sanscrit, whence *Eatooaa*, among the former, is *God the Spirit*, or the *Divine Spirit*, *ea* meaning a *spirit* in these islands. They also apply the Hebrew *el*, as the Pelasgians and the Greeks did, to denote the *sun*; whence *ellangee* means the *sky*, or sun's residence, and *papa-ellangee*, *father of the sky or spirits*.

"The most common term for *death*, amongst all nations, is, *mor*, *mort*, or *mut*. It is *mut* in Hebrew and Phœnician; it is *mor*, or *mort*, in Sanscrit, Persian, Greek, and Latin; it is the same in almost all the European languages; and it was with no small astonishment, the learned lately discovered that it is the same in *Otaheite*, and some other of the Polynesian Islands, in which *mor-ai* is well known to signify a sepulchre, or, literally, *the place or region of the dead; ai* meaning a *place* or *region* in the Otaheitan, precisely as it does in Greek; an elegant and expressive compound, which is, perhaps, only to be equalled by the Hebrew *zalmut*, literally *death shade*, but, in our Bibles, rendered *shadow of death*.*

"*Sir*, in our own language, is the common title of respect; and the same term is employed, in the same sense, throughout every quarter of the globe. In Hebrew, *sir*, or *sher*, imports *a ruler*, or *governor*; in Sanscrit and Persian, it means the *organ of the head itself;* in Greek, it is synonymous with *Lord;* in Arabia, Turkey, and amongst the Peruvians in South America, it is employed as in the Greek; and is not essentially different in Spain, Portugal, Italy, and France. In Germany, Holland, and the contiguous countries, the *s* of the Hebrew *sher*, is dropped, and it is converted into *her*.

"*Man*, in Hebrew, occurs under the form of *maneh*, a verb signifying to *discern* or *discriminate*, and, as a noun, signifying *a discriminating being*. In Sanscrit, we have both these senses. Hence, *menu*, in both Sanscrit and ancient Egyptian, means *Adam*, or the *first man*, emphatically THE *man*. *Menes* was the first king of Egypt, and *Minos* the chief judge amongst the Greeks. Hence, also, in Greek, *men* and *menos*, signifying *mind*, and the Latin *mens*, the mind, is the same. In the Gothic, and in all the northern dialects of Europe, *man* imports the same idea as in our own tongue. In Bengal and Hindostan, it is *manshee;* in the Malayan, *manizu;* in Japanese, *manio;* in Atooi, and in the Sandwich islands generally, *tane*, *tanato*, or *tangi*, while *manawe* imports the *mind* or *spirit;* and in New Guinea, or Papuan, it is *sonaman*. In this utmost extremity of the southern world, we also meet with the term *Sytan*, for Satan, or the source of evil; and Wath (German *Goth*,) for God. But it may perhaps be observed, that, in all the southern dialects of Europe, we meet with no such term as *man*, nor even in the Latin, from which so many European languages are derived, and which has *homo* for man. Yet, it is clear, that *homo* itself is derived from the common root. Its adjective is *hu-man-us*, human, while *man*, or *min*, is found in every inflection below the nominative case, as *homin-is*, &c.: the former nominative itself was *ho-men*, from whence it is clear that *ho* is redundant, and did not originally belong to the word. The negative of *homo* is *ne-homo*, now pronounced *nemo* in the Latin; in which latter the *ho* has been dropped. The *ho* is also omitted in the feminine of *homo*, which is *fe-min-a*, and was, at first, FEO *min-a*, from *feo*, to produce; literally, the *producer of man* or *min*. From *feo-min-a*, we have also our own, and the common Saxon term *wo-man*, the *f*, and *v*, or *w*, being convertible letters in all languages, of which we have a familiar instance in the words *vater* and *father*, in German, and English."

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* In Otaheite, the natives direct their voyages by the sun, moon, and stars; and they have names for many of the constellations, resembling, in several instances, those of the Greeks.

All the above cases, and many more that might be produced, are confederating proofs, that the various languages and dialects that are now, or ever have been spoken, have originated from one common source; and that the various nations that now exist, or ever have existed since the deluge, have originated from one common cradle or quarter of the world; and that that quarter was an eastern region, as we might, *a priori*, have supposed, from Asia having been the first land peopled after the flood.

"But besides this singular coincidence in language, over the whole inhabited earth, there is, also, a most remarkable confirmation of the same *unity of origin*, in the correspondence between all nations whatever, where any traces of the art of arithmetic exist, in the employment of a DECIMAL *gradation*.

"Whence comes it to pass, that *blacks* and *whites*, in every quarter, the savage and the civilized, wherever a human community has been found, have neither *stopped short of*, nor *exceeded* a series of *ten* in their calculations; and that as soon as they have reached this number, they have, uniformly, begun a second series with the first unit in the scale, as *one ten, two ten*, &c.? Why have not some nations broke off at *five*, or others proceeded to *fifteen* before they began a second series? Or why have the generality of them had any thing more than one single and *infinitesimal* series, and consequently, a new name for every *unit?* Such an universality cannot possibly have existed, except from a like universality of cause; and we have, in this single instance alone, a proof equal to mathematical demonstration, that the different languages into which it enters, and of which it forms so prominent a feature, must, assuredly, have originated not from *accident*, at different *times*, and in different *places*, but from direct determination and design, at the *same time*, and in the *same place;* that it must be the result of one grand, comprehensive, and original system. *Such system could not have been of human invention:* what then remains for us, but to confess that it must have been of Divine and Supernatural communication?

"Such examples, though few, are abundantly sufficient to establish the point; and they even lead us to a second and catenating fact, namely, that the primary and original language of man, that language divinely and supernaturally communicated to him, in the early ages of the world, has been *broken up*, *confounded*, and *scattered*, in various fragments, over every part of the habitable globe; that the same sort of disruption that has confounded former continents and oceans, and intermingled the productions natural to different hemispheres and latitudes, this same Power has assaulted the world's primeval tongue, has overwhelmed a great part of it, wrecked the remainder on distant and opposite shores, and turned up new materials out of the general convulsion: and if it were possible for us to meet with an ancient historical record, which professed to contain a plain and simple statement of such supernatural communication, and such subsequent *confusion of tongues*, it would be a book, which, independently of any other information, would be amply entitled to our attention, *for it would thus bear an index of commanding authority on its own forehead.*

"Such a book is now in our hands. Let us prize it, *for it must be the* Word of God, as it bears the direct stamp and testimony of His works."*

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* The Book of Nature, by Dr. Mason Good.

CONCLUSIONS

To which we are naturally led by the general tenor of the foregoing inquiry.

Having completed the proposed general survey of the system of geological phenomena, on every part of the earth's surface, let us now take a retrospective view of the various conclusions to which we have been led, in regarding the Creation, and the laws to which all created beings have been submitted by the Almighty. And, first, we have found it *unreasonable*, and *unphilosophical*, to subscribe to the doctrines, too commonly taught, wherein the first production of all things is supposed to have arisen by the *mere laws of nature*, or from *secondary causes, within a chaotic or imperfect mass;* because, in adopting this opinion, we find ourselves as far removed as ever from the ORIGIN *of things* of which we were in search: for even were we to admit, with the Wernerian school of philosophy, the primary existence of an *aqueous chaos*, and that the *laws of nature* have, in an indefinitely long period of time, gradually produced the beautiful order and arrangement we now admire in the universe; we should still have to account for the *component parts* of that chaotic mass, *which could not have come into being by any of the known laws of nature:* and being thus driven to acknowledge a Creative Power, capable of producing *even a chaos* out of nothing, and of establishing those wonderful laws which now govern the world, we should find ourselves, without any available object, derogating from the Wisdom and Power of a Creator, by denying a PERFECT *creation* of all things in the beginning. If we are forced to this conclusion, with regard to the actual structure of the mineral body of the earth, we are even more forcibly convinced of this great truth, by a survey of the animal and vegetable world with which it is furnished. For when we consider the evident *design*, which is so remarkably displayed in the structure of these bodies, we must feel satisfied, that though the *laws of nature* may, and do, now *regulate* them, they never could have, at first, *produced* them. We have found, that as it is unreasonable to suppose the first man to have ever been *an infant*, or the first oak tree to have sprung from *an acorn*, we are forced to the adoption of the only other alternative left for our choice; and we must, therefore, conclude, that both animal and vegetable productions were, at first, CREATED in their *mature* and *perfect* forms, and were then submitted to those laws which have ever since been in action in the world. And when we are unavoidably led thus far by our *reason* alone, and when we then consult the only History of the early events of the world that is within our reach, we find this Record announcing, in the most unequivocal terms, that "in the begining, God CREATED the heaven and the earth;" and that, "in *six days* He made heaven and earth, the sea, and all that in them is, resting on the seventh *day*, and hallowing it," as a day of rest and of worship for all the generations of men.

And with respect to the nature and duration of those *six days*, so particularly defined in the Record, which it pleased the Creator, for an obviously wise and beneficent end, to occupy in this *incomprehensible* work of creation, we can have no reasonable doubt that they were such days as are now, and ever have been, occasioned *by one revolution of the earth on its axis;* first, because a perfect creation may be as easily the work of one day, or of one moment, as of thousands of years; secondly, because the *supposed longer periods* of philosophy, were only called for in the erroneous idea of *gradual perfection*, from an *imperfect creation*, which idea we have found such reason altogether to condemn; and thirdly, because that Record, on the evidence of which our confidence has been confirmed, on the subject of *perfect creation*, has distinctly defined each of these days by its *evening* and its *morning*, which terms, so often repeated, can be, in no way, applicable to the supposed *indefinite periods* above alluded to.

Secondly,—We have found reason to conclude, that the first great geological change which took place after the *creation* of the solid mass of the globe, was occasioned by that *fiat* of the Almighty, on the third day, by which the waters, equally covering the whole mineral surface during the first and second days, were "gathered together into one place," that the "dry land" might appear; and as this "gathering together of the waters" of the sea, could not have taken place, according to the laws of *gravity* and of *fluids*, *by accumulation*, it must have been effected by a *depression* of a portion of the surface of the earth, into which the waters would naturally flow. This depression could not have taken place without a partial derangement of a thin portion of the earth's surface; and from this partial derangement, acted upon by the laws which have, at all times, governed the ocean, we derive the earliest *secondary formations*, now found resting upon the *primitive mineral mass*.

Thirdly,—We discover an adequate and reasonable origin for a great portion of the other secondary formations, now found upon the earth, in the action, during a period of sixteen hundred and fifty-six years, of those *laws of nature*, by which a constant removal of mineral *debris* is taking place, *from* the dry land, *to* the bed of the ocean: and in considering the existing action of those laws which govern the waters, we find a natural and easy solution of the problem of *horizontal stratification*, and individual mineral arrangement, which has occasioned so many erroneous conclusions in some schools of philosophy. And we further discover the most convincing proof of the erroneous nature of the Wernerian theory, of *primitive rocks* having been formed in an AQUEOUS *chaos*, in the circumstance of no *primitive creation*, such as *granite*, having ever been discovered amongst what are denominated secondary rocks, *although these latter are known to have arisen in the self-same* AQUEOUS *medium*.

Fourthly,—We have found, in considering the subject of the deluge, that, as the phenomena presented to our consideration, over every part of the present dry lands, correspond minutely with the terms of the Mosaic record, where it informs us of the intention of the Almighty to destroy the antediluvian dry lands, as well as their inhabitants; that great and awful judgment must have been occasioned by the gradual interchange of level between the former seas and lands: that we are, consequently, now inhabiting the bed of the antediluvian ocean; and that all the fossil remains of animals, or vegetables, now discovered in our rocks or soils, were either embedded in the course of the gravel formation of the secondary strata, under the waters of the former sea, (as in the case of the marine productions in chalk, and many other calcareous marine formations,) or were thrown into their present situations by the waters of the deluge, and embedded (as in the case of quadrupeds, vegetables, human beings and other *land productions*,) in the soft soils and strata so abundantly formed at that eventful period, by the *preternatural* supply of materials for secondary formations.

Fifthly,—As it can be plainly demonstrated, by existing causes, and existing phenomena, that the animals and plants, the fossil remains of which are now found in uncongenial climates, could not have existed *in a living state*, where their remains are often now discovered; as a general inundation could not possibly take place upon the globe, without the entire destruction of animal life, and the total overthrow of the whole vegetable kingdom; as it is a well-known law of nature, that animal bodies, when destroyed by drowning, *invariably float* at one period of their decomposition; and that almost all vegetable substances, being specifically lighter than water, must always come to the surface, at least for a time; and as such floating animal and vegetable bodies could not but follow the action of the *winds*, the *tides*, *and*, *more especially*, *the* CURRENTS *of the then universal ocean*, some of which currents have, at all times, a tendency *from the equatorial regions towards the poles;* from all these several reasons, we cannot come to any other rational conclusion, but that all the fossil remains *of land productions*, over the whole surface of the present dry lands, became embedded in their present situations at the period of the Mosaic deluge; and that, consequently, the climates of the earth have been, in no way, suddenly changed, as some philosophers have thought it necessary to suppose; but that, on the contrary, the antediluvian animals and plants must have been distributed over the various climates of the former dry lands, and in nearly the same latitudes in which similar existing species are now respectively found.

Sixthly,—As we have found the most conclusive proofs, that, amongst other animal fossils, the remains of the *human race* are not unfrequently found, although, in that small numerical proportion to those of other species, which the sacred history would lead us to expect, we must entirely reject those doctrines of philosophy which teach a *gradual perfection* in the animal creation; and which suppose that man was not yet created, at the period when those animals, the remains of which we now discover, existed on the earth.

Seventhly,—We feel our belief in the Mosaic record, of all these wonderful events, strengthened and confirmed by the many traditional, and other proofs that have been brought forward, of all the present human race, in every climate of the world, having sprung from *one family*, and from *one period*, which period was that of the Mosaic deluge; and that that *post-diluvian* family origin must have first arisen *in Asia*, is proved by the affinity of so many common expressions in the languages of even the most remote islands, with the original languages of that portion of the globe.

Lastly,—As all these conclusions, to which we have been naturally led, in the course of this inquiry, tend to corroborate, in the most distinct manner, the history of the early events on the earth, as given in the Mosaic, and other books of Scripture, our confidence in the unerring accuracy of these records, is firmly established; for by such collateral evidence we should try the veracity of any other ancient history: but when we add to the usual qualifications of a correct historian, the incomprehensible guidance of *divine inspiration*, so clearly evinced by numerous prophecies distinctly fulfilled, we feel that the conclusions to which our inquiries have conducted us, by the simple evidence of reason and of facts, are only such as might have been anticipated, when we consider the unerring source from which this divine guidance or inspiration flowed; and that both the events, and the inspired record of them, which has been so wonderfully preserved for our information, are SUPERNATURAL and DIVINE.

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